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POWER

FEBRUARY, 1945

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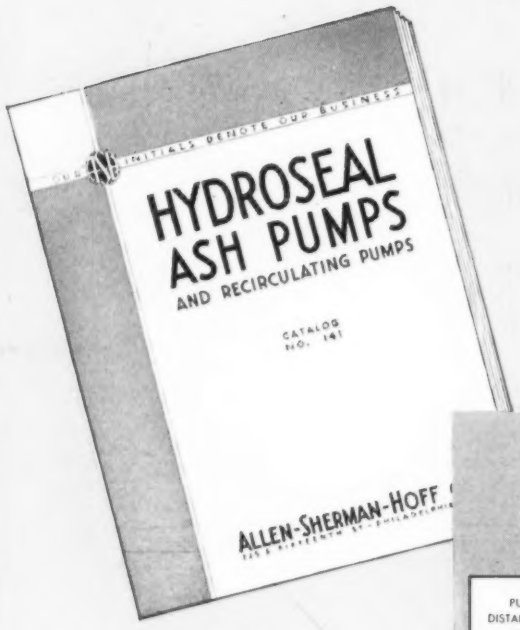
POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRY

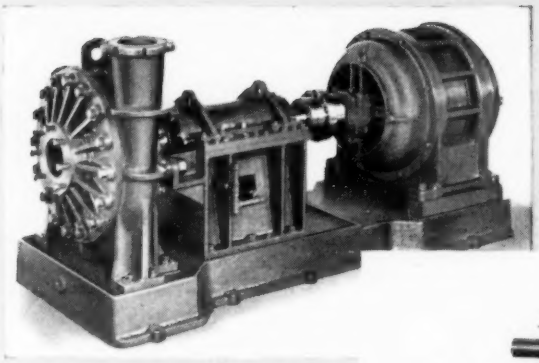
Boiler-car control center of 10,000-kw mobile power plant built by GE for Navy

TABLE OF CONTENTS
Page 59

Isometrics—Special section in color shows how to make all kinds of 3-dimensional engineering sketches, ranging from simplest shapes to piping, tanks and buildings. Isometric drawings help power engineers present plans to executives and assistants who can't read blueprints. Eight instruction pages start p 87

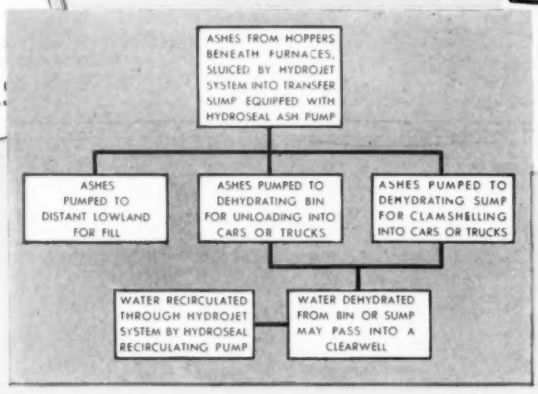
Water rheostat, built on the job, provides load for diesel acceptance tests. Engineer tells in detail how rheostat was designed and how use of scale models made it possible to predict performance accurately. Turn to p 70

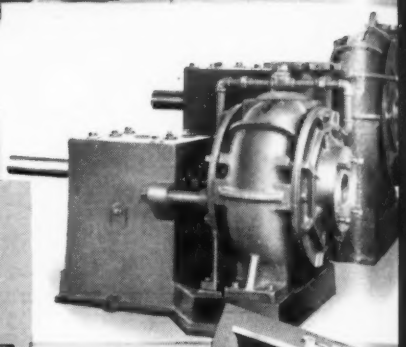


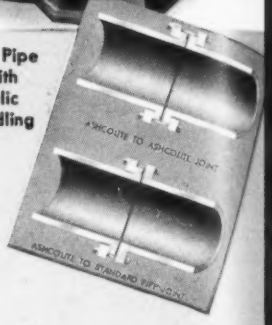


Hydroseal Recirculating Pump

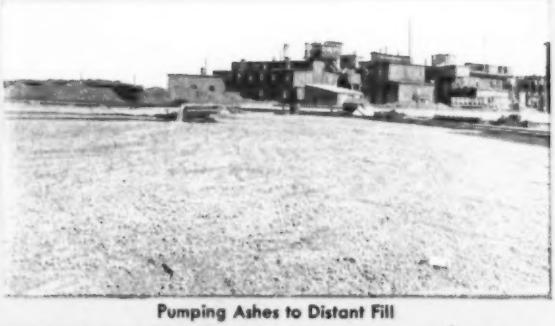
Hydroseal Ash Pumps


ASHES FROM HOPPERS BENEATH FURNACES, SLUICED BY HYDROJET SYSTEM INTO TRANSFER SUMP EQUIPPED WITH HYDROSEAL ASH PUMP
ASHES PUMPED TO DISTANT LOWLAND FOR FILL
ASHES PUMPED TO DEHYDRATING BIN FOR UNLOADING INTO CARS OR TRUCKS
ASHES PUMPED TO DEHYDRATING SUMP FOR CLAMSHELLING INTO CARS OR TRUCKS
WATER RECIRCULATED THROUGH HYDROJET SYSTEM BY HYDROSEAL RECIRCULATING PUMP
WATER DEHYDRATED FROM BIN OR SUMP MAY PASS INTO A CLEARWELL



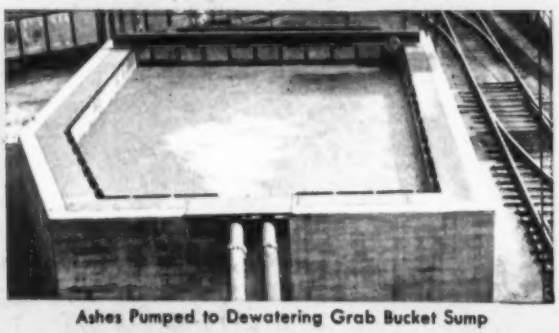


Ashcolite Pipe used with Hydraulic Ash Handling



Pumping Ashes to Distant Fill

Ashes Pumped to Dehydrating Storage Bin



Ashes Pumped to Dewatering Grab Bucket Sump

Guidebook For Planning Your Post War Ash And Dust Disposal

"PUMP YOUR ASHES" has been our cry, ever since the earliest days of the Hydrojet System. Hydroseal Pumps are now used under practically every conceivable condition, handling everything from stoker ash to precipitator dust. In practically every case, we have found that hydraulic ash handling is the most inexpensive method where the engineer considers maintenance, labor and power, in addition to first cost. . . . Hydroseal Ash and Recirculating Pumps are specially designed for economical handling of abrasive solutions. Before you get too far with your post war plans, get our Catalog No. 141, or talk to our nearest engineer.

HYDROSEAL PUMPS

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POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), February, 1945, Vol. 89, No. 2. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 16 shillings per year. All other countries, $6.00 for one year, $9.00 for two years. Single copies 35 cents.

How a Small Steam Plant Solved a Coal Handling Problem

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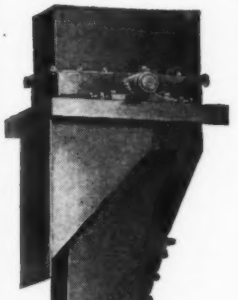
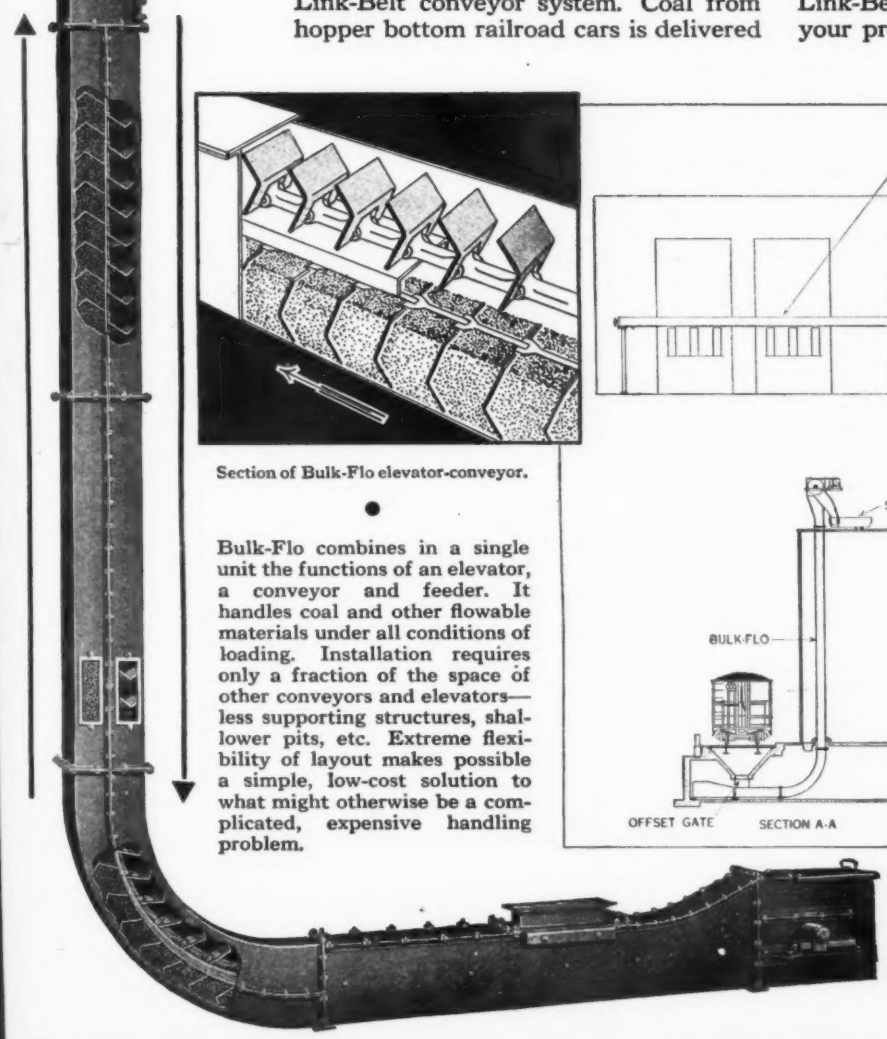


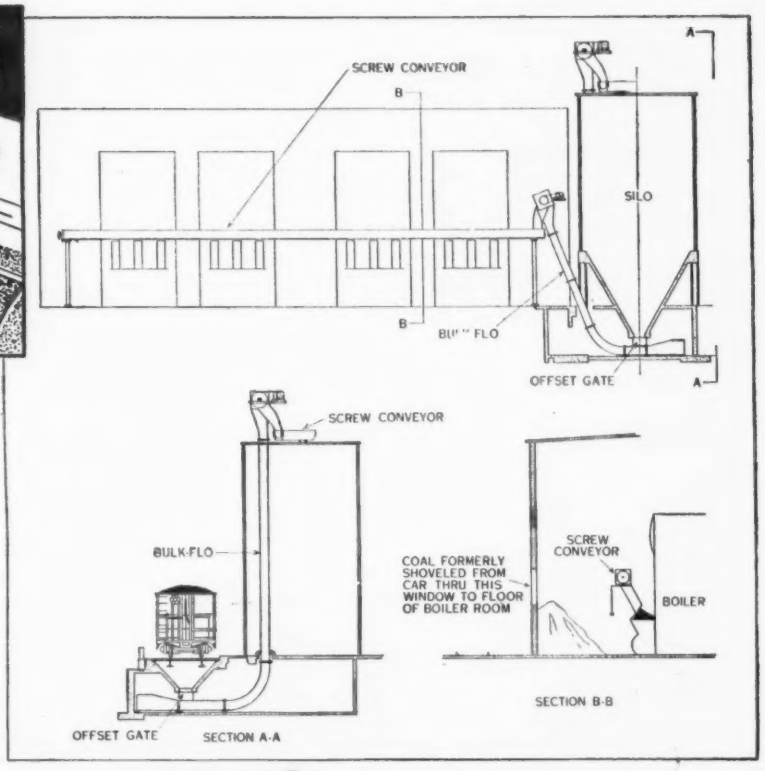


● Coal handling problems vary but all successful solutions require engineering experience and a wide variety of conveying equipment such as Link-Belt Company manufactures. Here is how a mid-west plant, burning from 5 to 10 cars of coal per day successfully solved their problem. Slow, dusty, labor wasting and costly hand shoveling has been replaced with this simple, clean, compact Link-Belt conveyor system. Coal from hopper bottom railroad cars is delivered to storage silo (200-ton capacity) with a Bulk-Flo elevator-conveyor (capable of handling 30 tons of coal per hour). On top of silo is a short horizontal screw conveyor discharging coal to center of silo. Another Bulk-Flo elevator-conveyor (capable of handling 15 tons per hour) delivers the coal from the silo to a horizontal screw conveyor which feeds all twelve stoker hoppers of the four boilers. Link-Belt is prepared to help you solve your problems. Send for Catalogs.

Section of Bulk-Flo elevator-conveyor.

●

Bulk-Flo combines in a single unit the functions of an elevator, a conveyor and feeder. It handles coal and other flowable materials under all conditions of loading. Installation requires only a fraction of the space of other conveyors and elevators—less supporting structures, shallower pits, etc. Extreme flexibility of layout makes possible a simple, low-cost solution to what might otherwise be a complicated, expensive handling problem.



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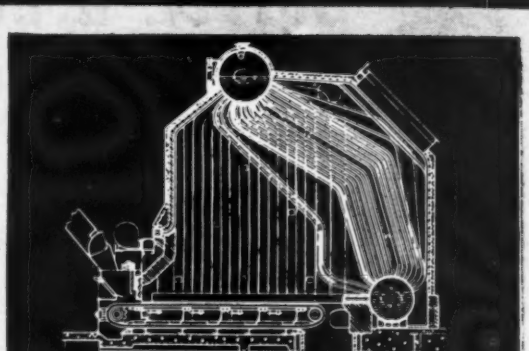
PRACTICAL PLANS for

In the wake of this war will come new jobs for steam . . . new opportunities . . . new problems . . . keener competition . . . that will put renewed emphasis on power plant reliability, efficiency, and operating costs.

When the urgency of war production begins to unwind into the pattern of peacetime competition, power plant engineers will want to be ready in advance with step-by-step plans for urgently needed modernization and expansion of existing facilities. Properly drawn, such plans will help speed reconversion of their own industries and hasten action in providing for fully integrated power services having the high overall efficiency and flexibility for changing conditions that future operations will demand.

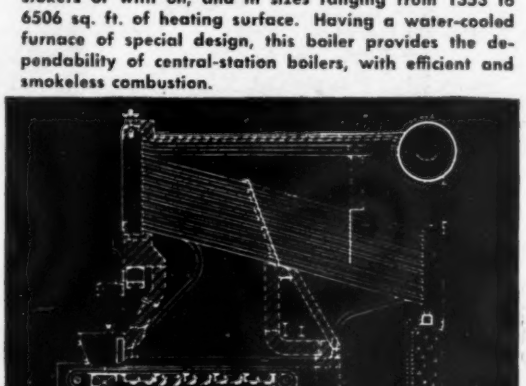
Thinking and planning for tomorrow *today* is a job B&W engineers are ready to tackle in partnership with power engineers of industry. Their long leadership in meeting steam power requirements has been greatly augmented by much more valuable experience gained in serving the industry war needs.

When the time comes to specify equipment for the future, there is a B&W boiler for any combination of conditions . . . capacity, pressure, temperature, feedwater, fuel and space . . . to be met. Whatever the type needed, it is built for the job, thus assuring the highest standards of performance, continuity of service, high overall station economy and greatest return on the investment.



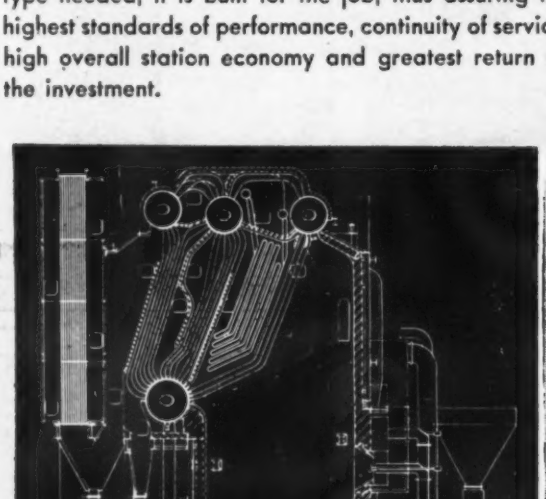
B&W INTEGRAL-FURNACE BOILER (CLASSES 9, 12, & 15)

This Integral-Furnace Boiler is available for firing with stokers or with oil, and in sizes ranging from 1353 to 6506 sq. ft. of heating surface. Having a water-cooled furnace of special design, this boiler provides the dependability of central-station boilers, with efficient and smokeless combustion.



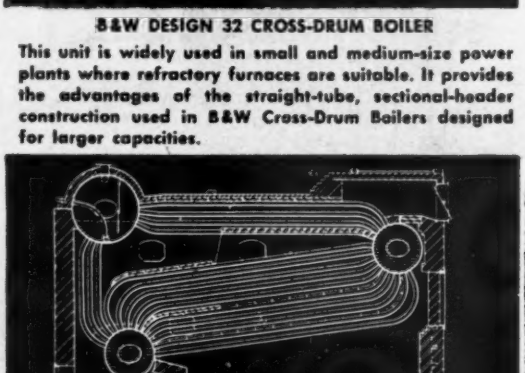
B&W DESIGN 32 CROSS-DRUM BOILER

This unit is widely used in small and medium-size power plants where refractory furnaces are suitable. It provides the advantages of the straight-tube, sectional-header construction used in B&W Cross-Drum Boilers designed for larger capacities.



STIRLING BOILER

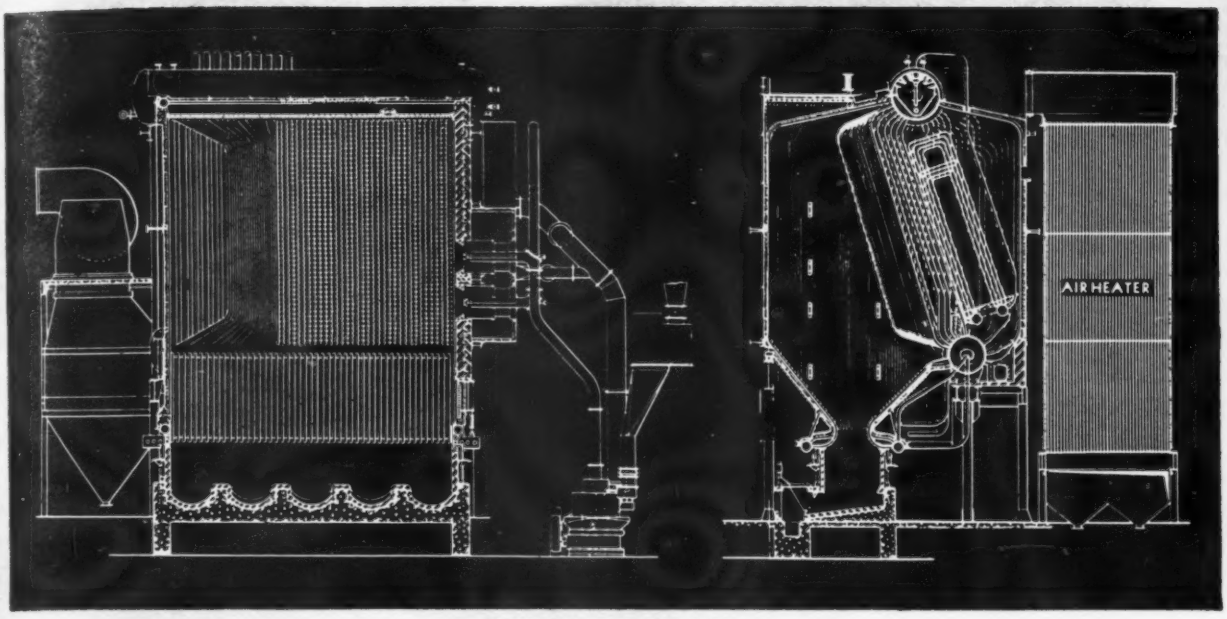
The Stirling Boiler fully meets the requirements of modern operating conditions. It readily responds to sudden and heavy demands for steam, and delivers dry steam at relatively high ratings when operated with water having a high concentration of solids. May be fired with any fuel.



TYPE H STIRLING BOILER

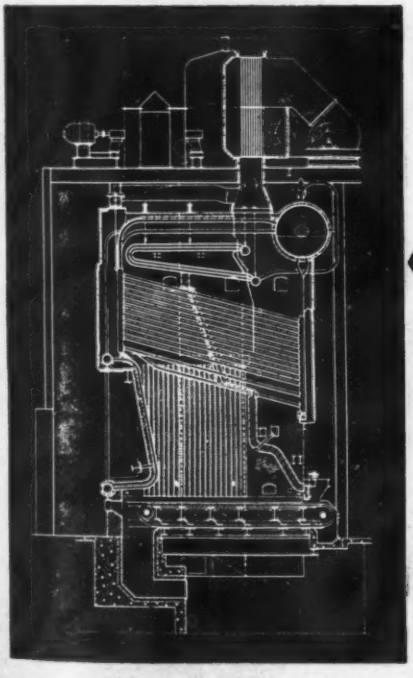
A low-head moderate-pressure unit that is widely used in small industrial plants, institutions, hotels, office buildings and to meet other similar requirements. Available in capacities ranging from 1500 to 30,000 lb. steam per hr. and for firing with any fuel. The furnace, usually of refractory, provides the necessary degree of dependability.

PEACETIME POWER . . .



INTEGRAL-FURNACE BOILER

The Integral-Furnace Boiler is a completely co-ordinated unit built in capacities up to 250,000 lb. steam per hr. and for the pressures and temperatures required by the most up-to-date and efficient prime movers. It is designed to burn pulverized solid fuels, oil, or gas, singly or in combination, thus utilizing at high combustion efficiency the least expensive fuel obtainable in any locality.

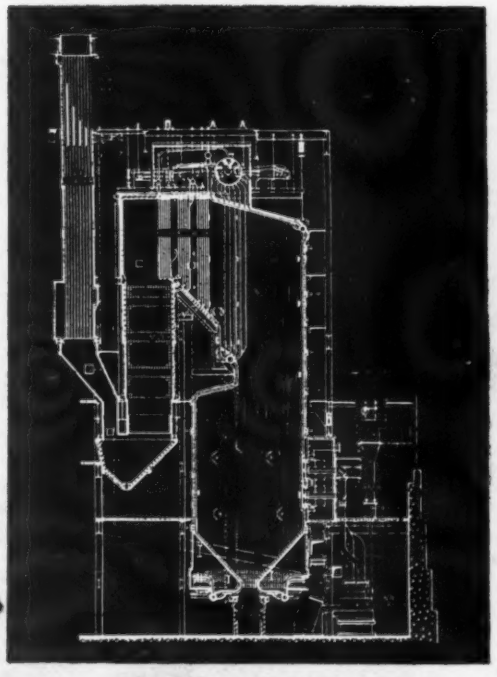


B&W CROSS-DRUM BOILER

This straight-tube sectional-header boiler is noted for its dependability, long life, and ability to deliver dry steam at high ratings. Can be readily inspected and cleaned.

CENTRAL-STATION BOILERS

High-duty boilers for central-station service are available in several basic designs to meet the requirements of individual stations. The Radiant boiler unit illustrated is typical of some of the units now operating at high rates in utility plants.



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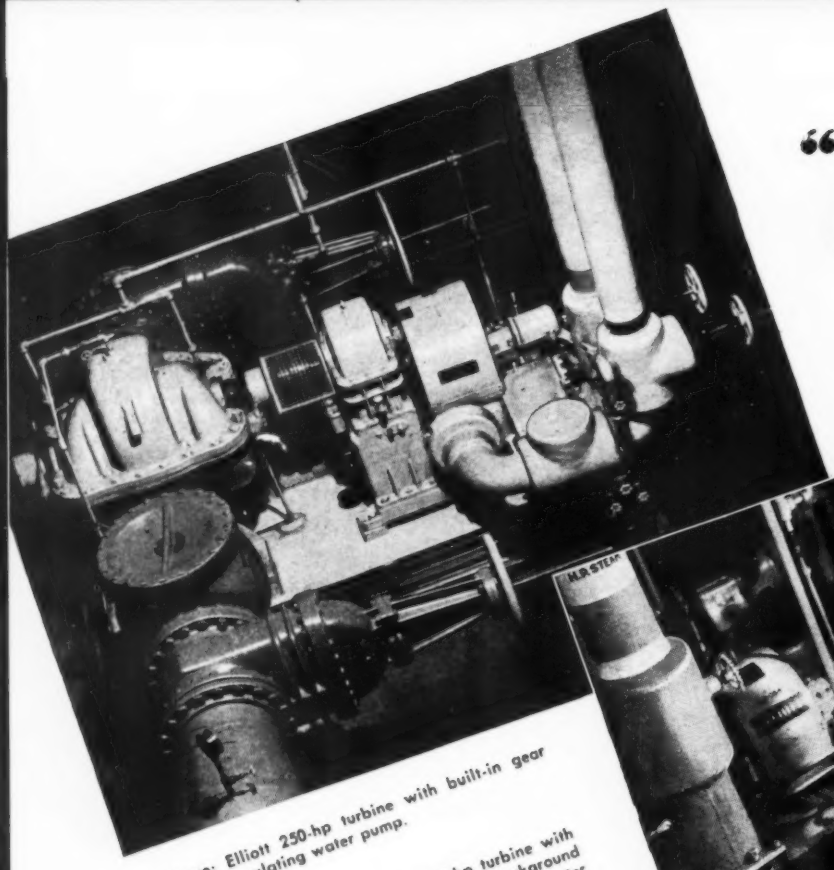
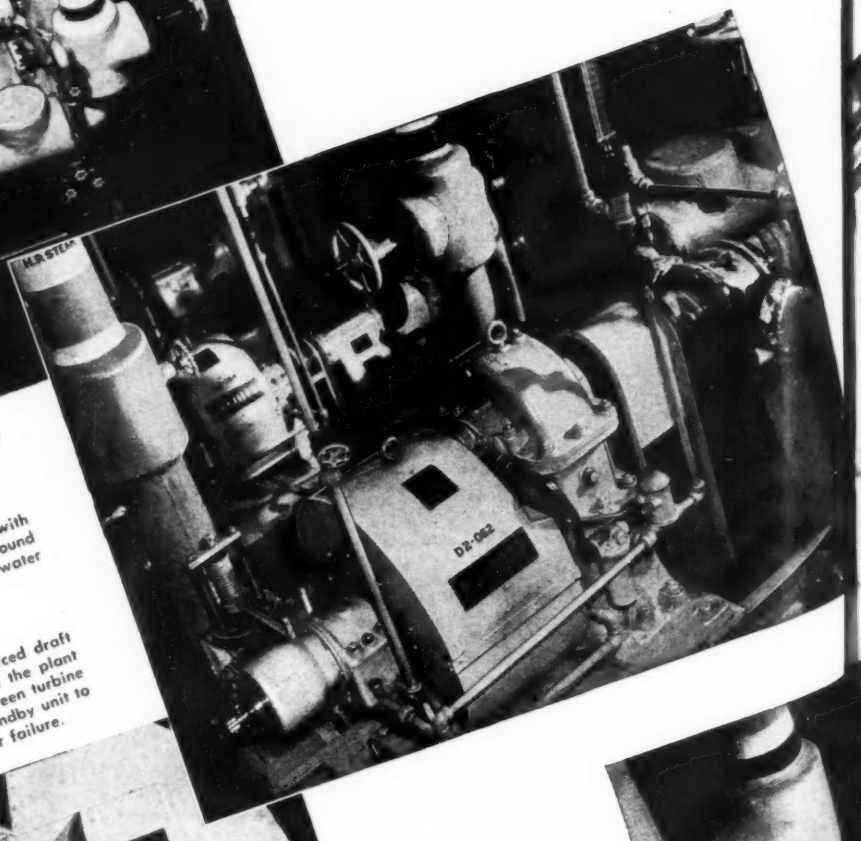
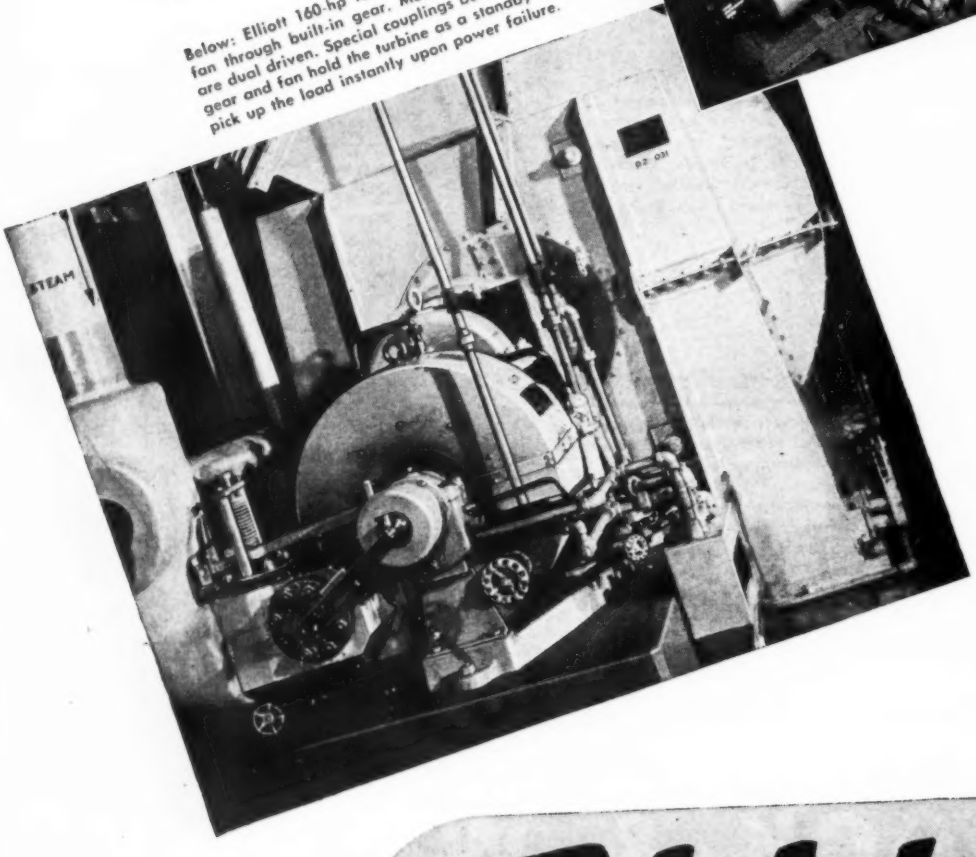


Above: Elliott 250-hp turbine with built-in gear driving circulating water pump.



At right: In foreground Elliott 25-hp turbine with built-in gear driving fuel oil pump. In background an Elliott 20-hp turbine for a treated water make-up pump

Below: Elliott 160-hp turbine driving forced draft fan through built-in gear. Most fans in the plant are dual driven. Special couplings between turbine gear and fan hold the turbine as a standby unit to pick up the load instantly upon power failure.

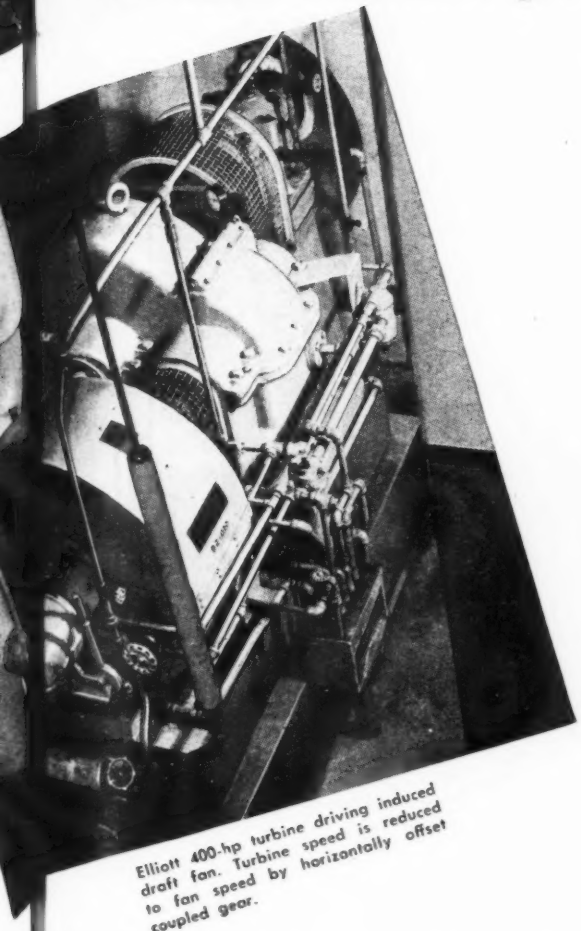


ELLIOTT

*continuous service"**

auxiliary drive turbines by . . ELLIOTT

at the steam plant of Kaiser Company Inc



Elliott 400-hp turbine driving induced draft fan. Turbine speed is reduced to fan speed by horizontally offset coupled gear.

It took a war to do it—to call into being America's vast, hidden capabilities in manufacturing and ship building. The iron and steel plant of Kaiser Company, Inc., Fontana, Calif., is a famous example.

To build ships they needed steel plate. To make plate they built a steel plant. Built it fast — but carefully, served by selected and proven equipment . . . such as the nineteen Elliott mechanical drive turbines which power the steam plant auxiliaries and various pumps in the by-products plant. These are units that must keep going — and they do, with characteristic Elliott reliability. You might say the plant depends upon their faithful operation, and in a number of the drive functions it does.

Elliott mechanical drive turbines are selected for so many critical drive jobs that their sure performance has become almost traditional.

Built in several types, and supplied when required with built-in reduction gears. Full details in the descriptive bulletins, sent on request.

**Quoted from an interesting descriptive article on the Kaiser Company's steam plant, by Mr. H. H. Hyde, project engineer, Bechtel-McCone-Parsons Corporation, and to be published in the Spring issue of POWERFAX. Copy on request.*

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DIAMOND AUTOMATIC SEQUENTIAL

When a boiler is equipped with Diamond Automatic Sequential Air Puff Soot Blowers, none of the situations you see illustrated at the right can happen. In the first place, there is no attendant because the entire soot blowing system is operated by simply opening a valve on master controller or by pushing a "start" button on a program panel which can be a part of the boiler and turbine control board.

Then, being automatically controlled, the soot blowers always operate in the same sequence and with the same blowing time. No blower unit can be overlooked or incorrectly operated. Should it ever be found necessary to change the blowing sequence, it is easily accomplished by a simple change on the master controller.

The compressed air—having a greater density than steam—provides theoretically better cleaning. The air is discharged from the element nozzles in a series of short puffs with substantial pauses between. Spreading the cleaning cycle over a longer period of time permits use of a very small compressor.

This Diamond equipment has been in very successful central station use since 1940. For further information, write for Bulletin No. 956 which illustrates and describes an installation on a 900,000 lb/hr boiler in a modern eastern central station.

Other Features

SAVES LABOR

—no attendant needed to drain piping, warm it up and operate each individual blower.

NO FEED WATER MAKEUP

—using compressed air instead of steam.

SAVES FUEL

—uses only ⅓ to ⅔ of energy from coal pile that is needed for steam blowing.

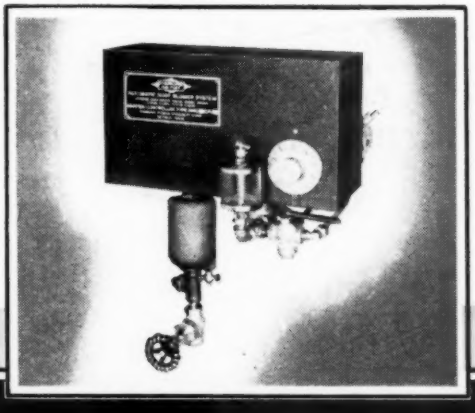
ELIMINATES STACK DISCHARGE NUISANCE

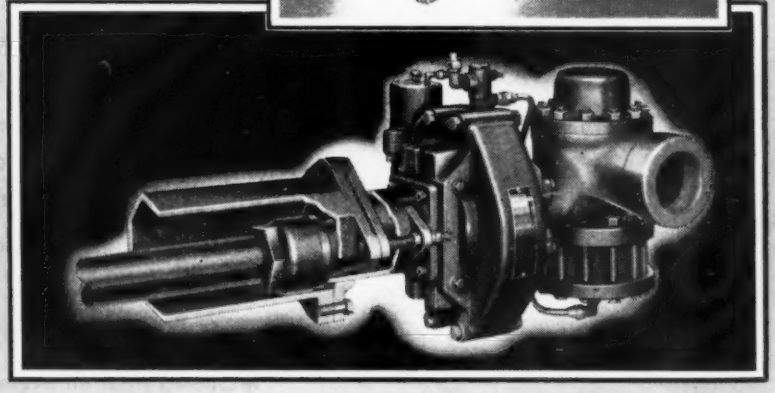
—intermittent operation expels soot from boiler in small quantities.

REDUCES MAINTENANCE

—experience on boilers in operation since 1940 proves maintenance unusually low.

(Right) Master Controller which automatically controls the sequence and blowing time of Diamond Air Puff Soot Blowers (see below) having elements permanently installed inside the setting.

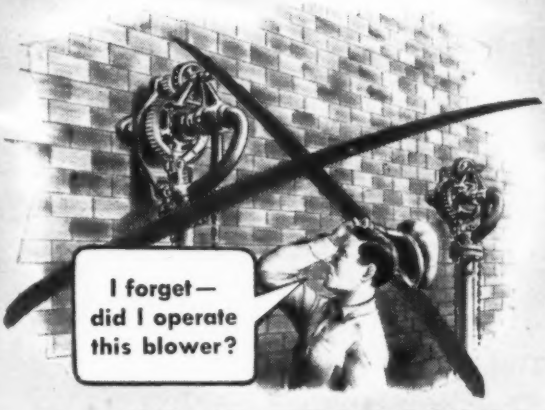


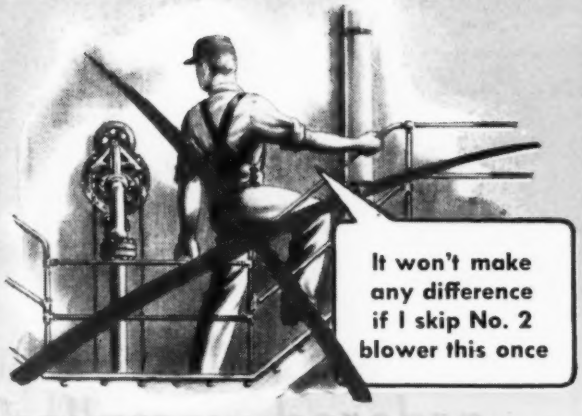


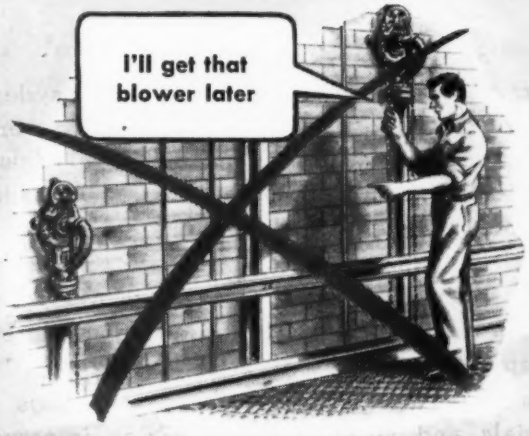
DIAMOND POWER

"Air Puff" SOOT BLOWING

Eliminates THE HUMAN ELEMENT and Assures CORRECT BOILER CLEANING







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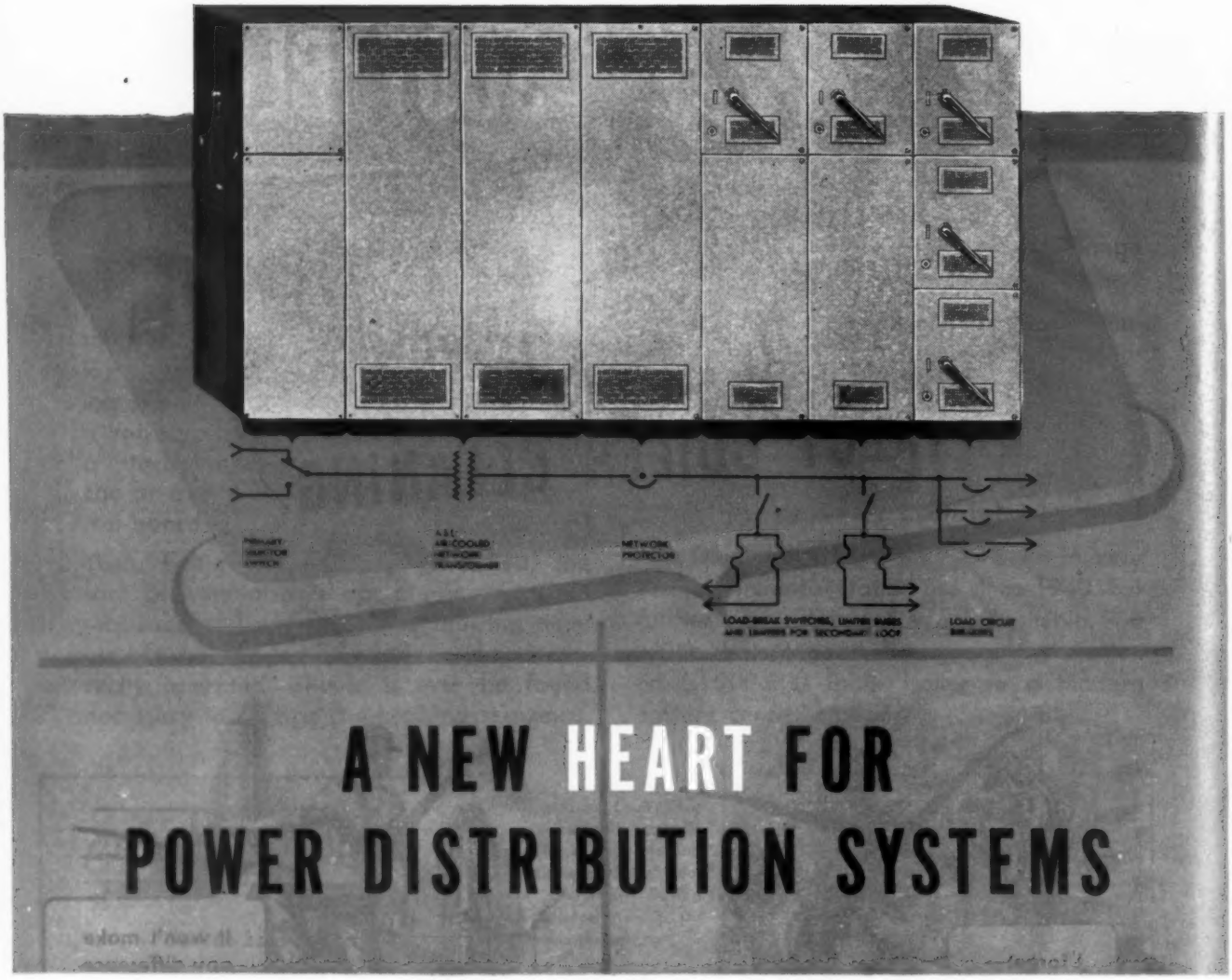

A NEW HEART FOR POWER DISTRIBUTION SYSTEMS

ordered—installed—operated as a unit

Here is a new heart for power distribution systems—the *Westinghouse Network Unit.* It saves time in ordering, installation and operation. It eliminates piecemeal assembly on the job! It can be installed anywhere indoors without a vault—because it is completely air-cooled. It can be installed in the immediate vicinity of working personnel with complete safety, or it can be placed overhead to save valuable floor space.

This flexibility results in substantial savings in materials and labor, and in service interruptions, with consequent production losses. It permits location of the Network Unit at or near the centers of load.

The Westinghouse Air-cooled Network Unit is only one item of the complete equipment Westinghouse can supply. Others are: control centers, power centers, switches, breakers, capacitors, protective devices, switchgear—in fact, all the equipment needed for any power distribution system. By ordering from *one* supplier, you place responsibility in *one* place . . . save time in ordering, installation and co-ordination for operation.

Complete specifications on all equipment are available to help you PLAN NOW for postwar construction. Phone your Westinghouse Office, or write Westinghouse Electric & Mfg. Co., P. O. Box 868, Pittsburgh 30, Pennsylvania. J-94642

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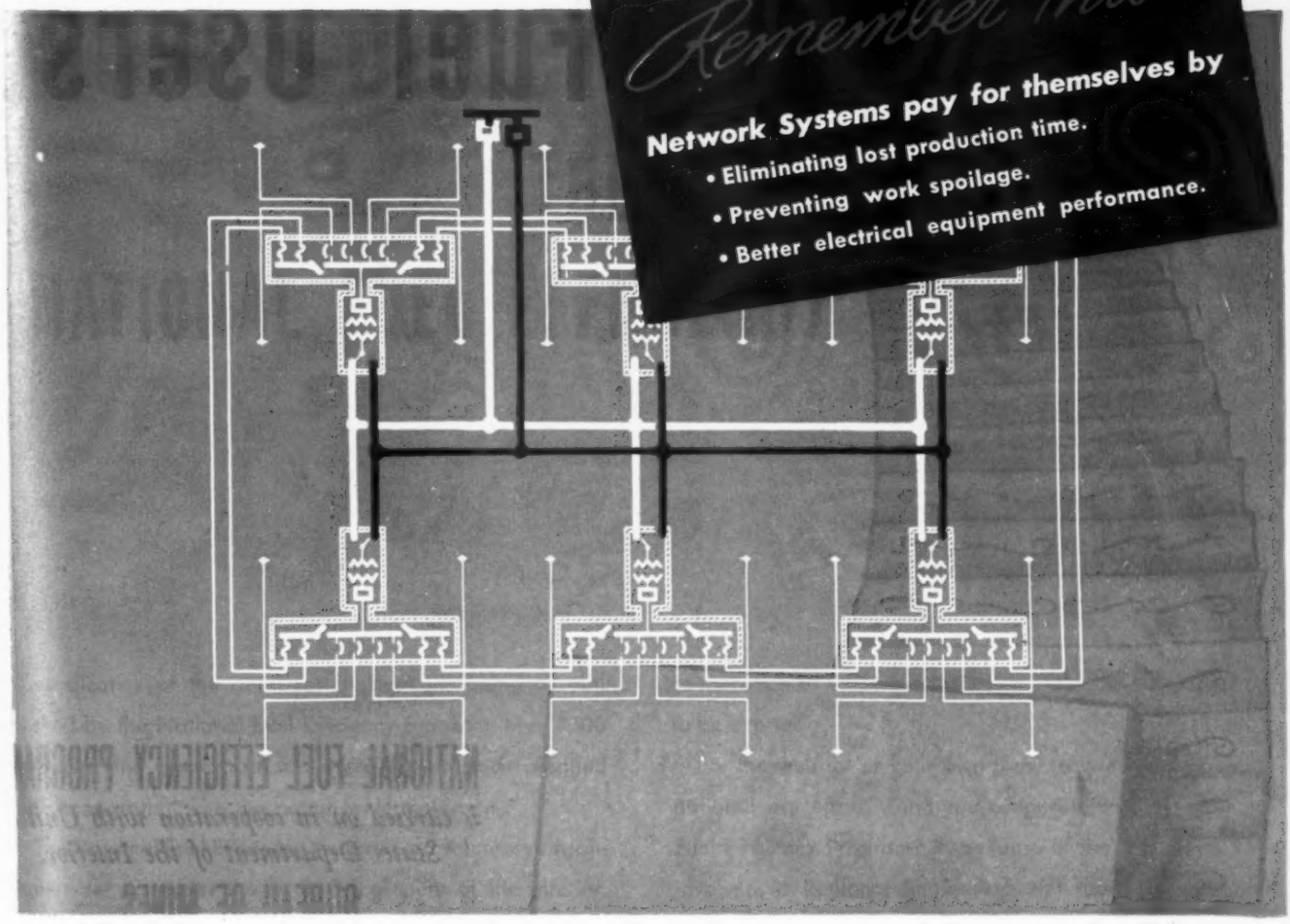
Remember This—
Network Systems pay for themselves by
• Eliminating lost production time.
• Preventing work spoilage.
• Better electrical equipment performance.

Since the first of the present-day Westinghouse industrial plant network system was installed four years ago, we have been receiving comments like these:

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- "light flicker has been entirely eliminated . . . improving working conditions and efficiency."
- "production has been increased because our motors are now getting the *right* voltage at *all* times . . . no longer any motor burnouts caused by undervoltage."
- "addition of new electrical facilities for critical work production was made in 50% less time . . . without disturbing any of the previous facilities."

We sincerely believe that wherever the highest degree of flexibility — reliability — and voltage regulation are "musts", the Westinghouse network system is best suited for tomorrow's profitable production of peacetime goods.

However, Westinghouse supplies all types of electrical distribution systems, and will recommend the one best suited to your needs.

Call your Westinghouse representative today for advice and *practical* help in laying out your postwar distribution system. It will pay you to blueprint now for tomorrow's needs.

PLANT DISTRIBUTION SYSTEMS

Over 7,500 Fuel Users..

NATIONAL FUEL EFFICIENCY PROGRAM

is carried on in cooperation with United States Department of the Interior.

BUREAU OF MINES

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THE
NATIONAL FUEL EFFICIENCY PROGRAM

Indicative of the good results that are being accomplished by the National Fuel Efficiency Program, over 7500 industrial and commercial fuel users have already pledged their cooperation with this nation-wide movement.

The National Fuel Efficiency Program is a voluntary organization set up under the U. S. Department of the Interior, Bureau of Mines, to help stretch the inadequate fuel supply of the nation by promoting greater fuel efficiency and reducing energy losses. The field force now comprises 184 local coordinators directing more than 5,000 Regional Engineers who visit cooperating plants and aid plant engineers and executives in finding and stopping "leaks" in equipment or practices which may be wasteful of fuel.

The more than 7500 "fuel users" who have also become "fuel savers" are evidence of the growing interest which the Program is arousing among thoughtful plant executives — an interest which must spread and develop to gain the active cooperation of every fuel user if serious fuel shortages are to be averted.

For the welfare of your own plant, as well as that of the national war effort, won't you cooperate with the National Fuel Efficiency Program? If, because of the burden of work involved, a Regional Engineer hasn't reached your plant yet, it is suggested that you take the initiative by writing to your local Coordinator, or to the National Fuel Efficiency Section, Bureau of Mines, U. S. Department of the Interior, Washington 25, D. C. A-851

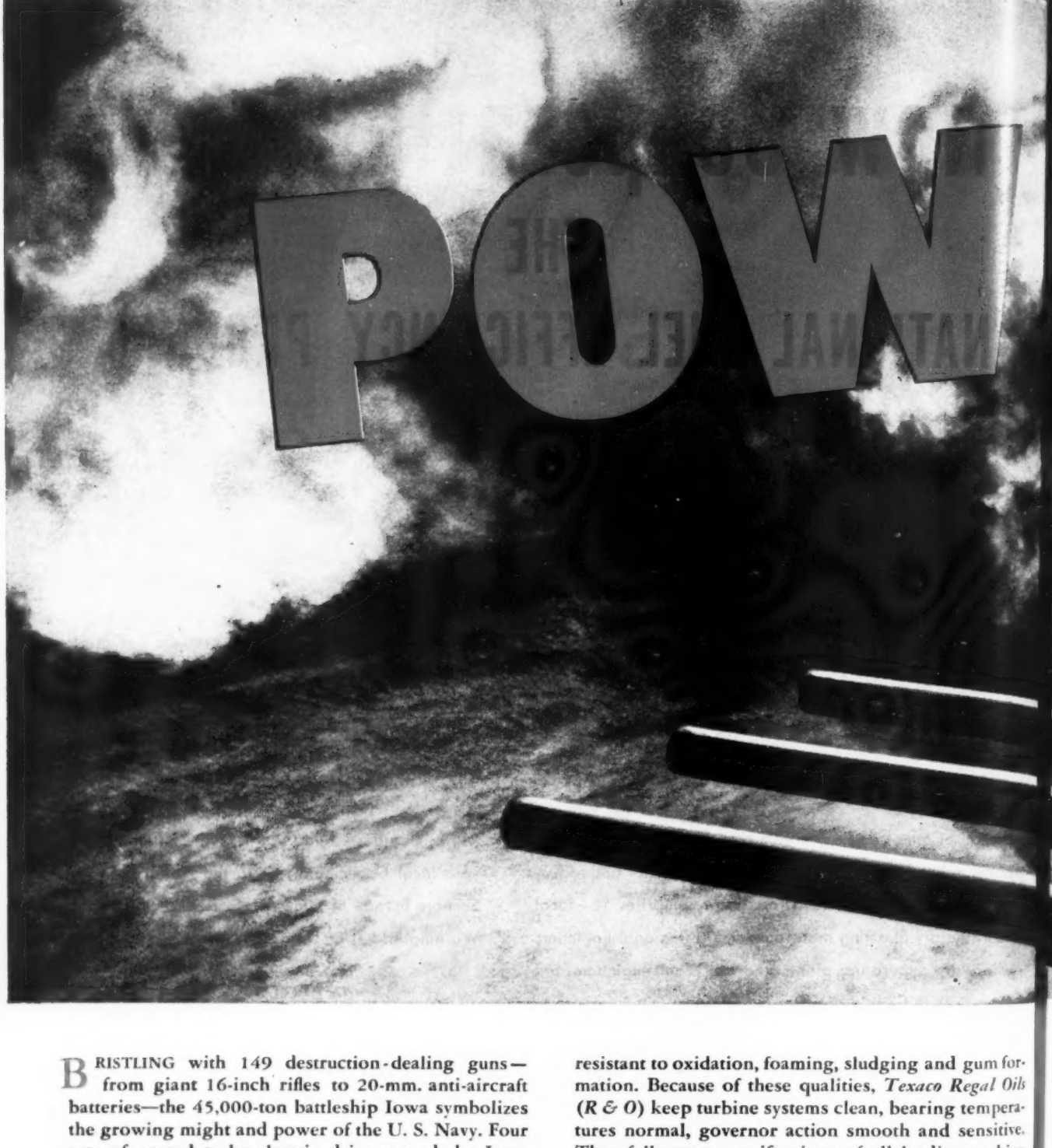
• • •

As specialists in the design and manufacture of equipment for efficient, economical steam generation, Combustion Engineering heartily endorses this Program which so closely parallels its own activities, and is glad to donate this advertising space to further the cause.

COMBUSTION ENGINEERING

200 MADISON AVENUE NEW YORK 16, N. Y.

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



BRISTLING with 149 destruction-dealing guns—from giant 16-inch rifles to 20-mm. anti-aircraft batteries—the 45,000-ton battleship Iowa symbolizes the growing might and power of the U. S. Navy. Four sets of geared turbo-electric drives speed the Iowa along at better than 30 knots, making her the fastest as well as the deadliest dreadnought afloat.

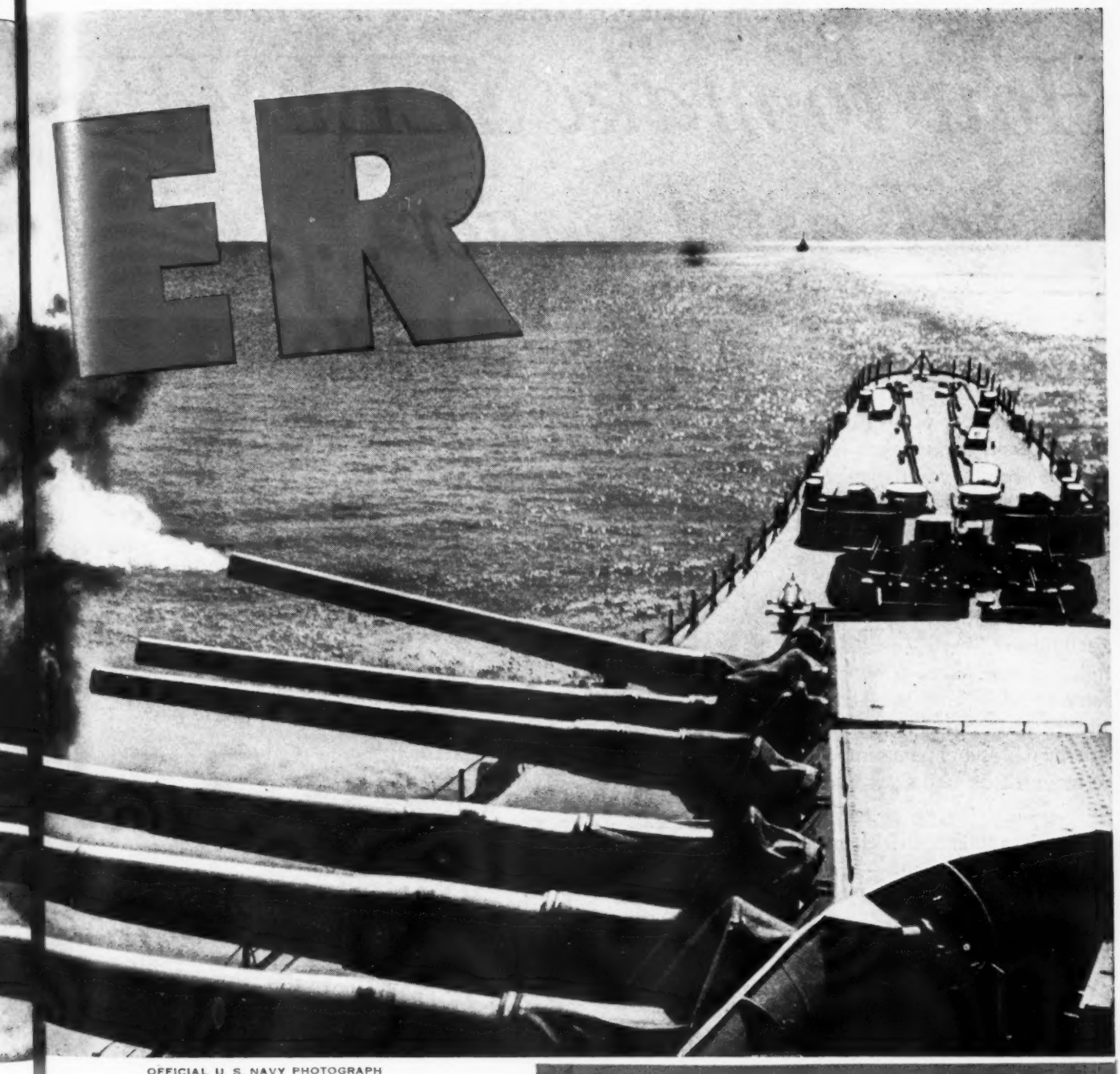
In every type of installation—large or small, on land or sea—where turbines are used to generate electrical power, they operate more efficiently, give more dependable service when lubricated effectively. That is why more and more engineers—in hydro and steam plants—use Texaco.

Texaco Regal Oils (*R & O*) are scientifically designed to prevent rusting of turbine parts. They are highly resistant to oxidation, foaming, sludging and gum formation. Because of these qualities, *Texaco Regal Oils* (*R & O*) keep turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. They fully meet specifications of all leading turbine builders and the turbine oil specifications of the U. S. Navy.

Texaco lubricants have proved so effective in service they are definitely preferred in many fields, a few of which are listed on opposite page.

For suggestions on the proper care of oil and maintenance of turbine systems, call on Texaco Lubrication Engineering Service, available through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, N.Y. 17, N.Y.

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIGHTS



OFFICIAL U. S. NAVY PHOTOGRAPH

THEY PREFER TEXACO

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

TEXACO

REG. T. M.

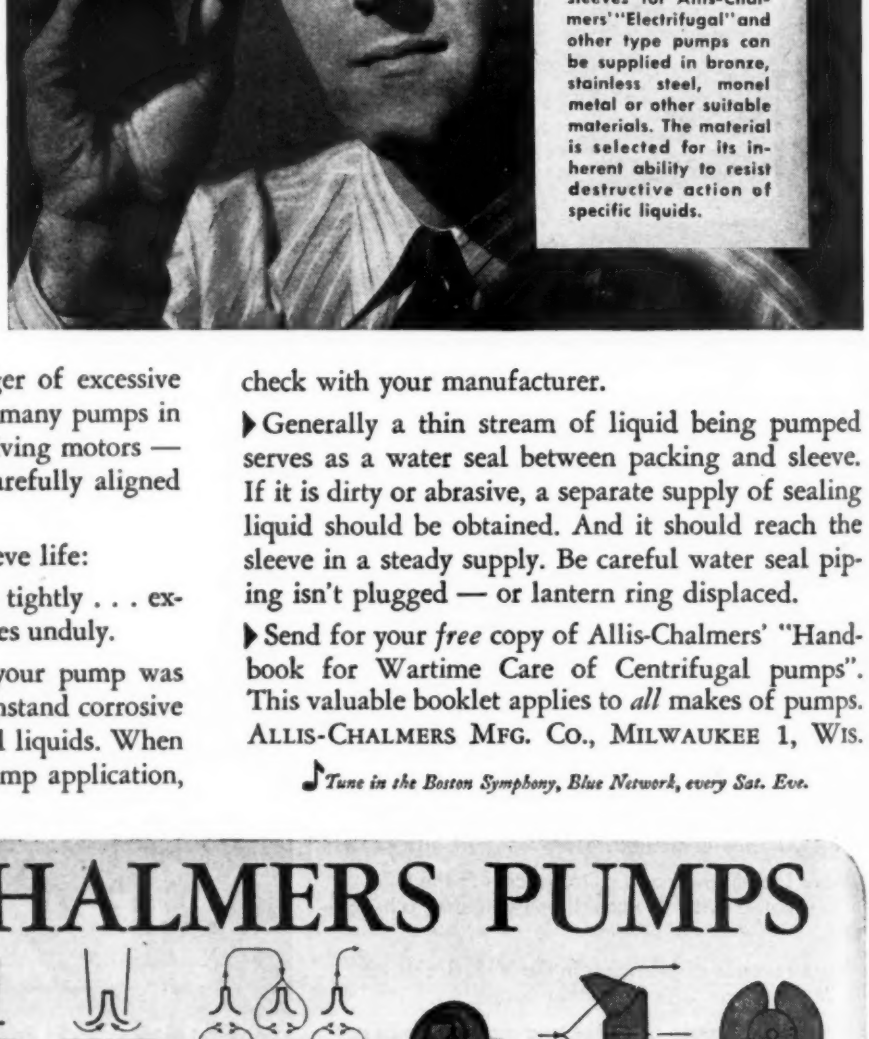
TEXACO

REGAL OILS (R&O)
FOR ALL TURBINES

METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS

[PUMP TIPS FROM ALLIS-CHALMERS—ONE IN A SERIES]

How to make SLEEVES Last Longer . . .



Depending upon the exact nature of the liquid to be pumped, shaft sleeves for Allis-Chalmers' "Electrifugal" and other type pumps can be supplied in bronze, stainless steel, monel metal or other suitable materials. The material is selected for its inherent ability to resist destructive action of specific liquids.

AS WITH MANY pump troubles, excessive sleeve wear is apt to trace back to misalignment of pump and motor. For when shaft is deflected, sleeve is apt to wobble within the packing — accelerating friction and wear.

So serious is this problem of misalignment, that Allis-Chalmers engineers were led to develop, for many applications, the famous "Electrifugal" pump — in which both the motor and pump impeller are mounted on one shaft and in one frame.

In such a pump the elements cannot get out of line — and danger of excessive sleeve wear is minimized. However, many pumps in use today are separate from their driving motors — and the coupling flanges must be carefully aligned . . . and *kept* in alignment!

Here are other ways to extend sleeve life:

▶ Don't draw stuffing box gland too tightly . . . excessive pressure will wear shaft sleeves unduly.

▶ Never pump a liquid for which your pump was not designed. Sleeves are able to withstand corrosive effects of some but not necessarily all liquids. When in doubt over safety of changing pump application, check with your manufacturer.

▶ Generally a thin stream of liquid being pumped serves as a water seal between packing and sleeve. If it is dirty or abrasive, a separate supply of sealing liquid should be obtained. And it should reach the sleeve in a steady supply. Be careful water seal piping isn't plugged — or lantern ring displaced.

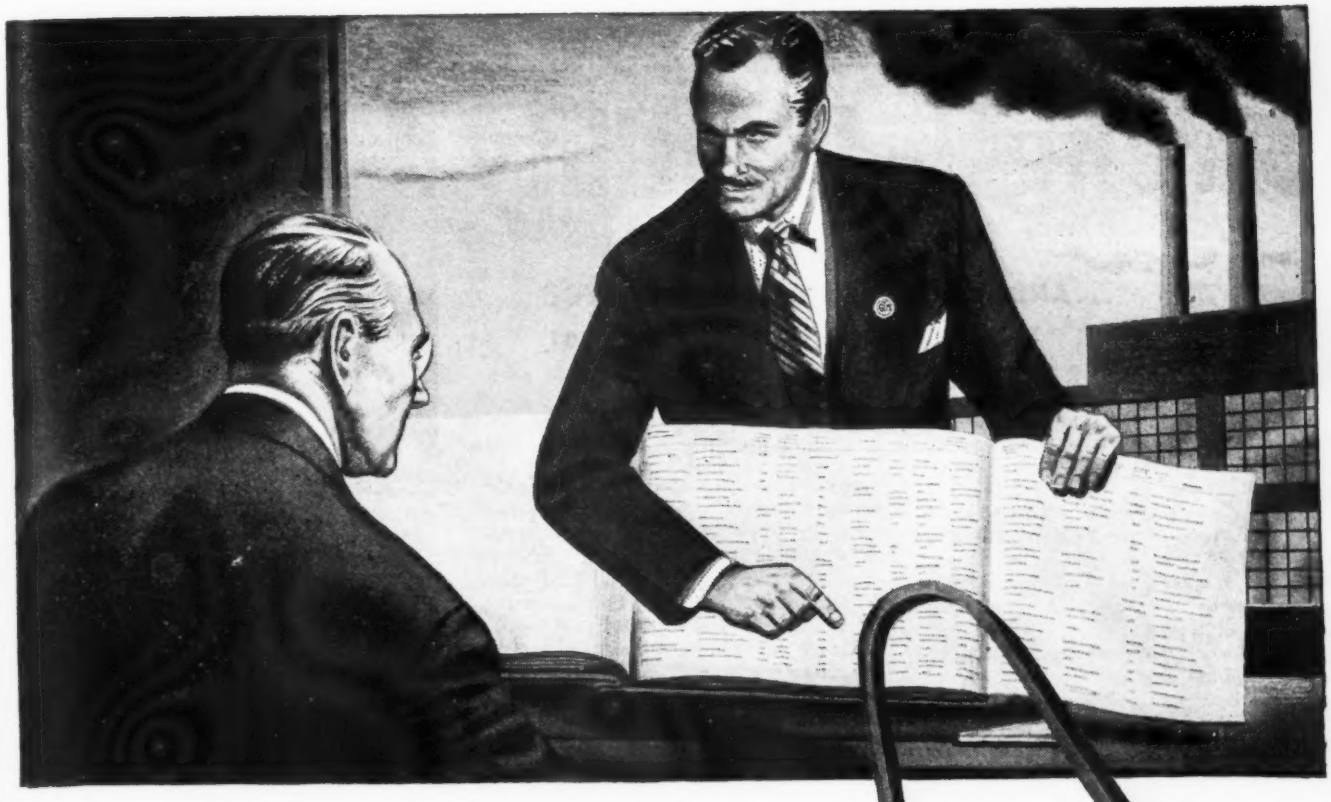
▶ Send for your *free* copy of Allis-Chalmers' "Handbook for Wartime Care of Centrifugal pumps". This valuable booklet applies to *all* makes of pumps. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

A 1708

ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.



NO OTHER V-BELT CAN MATCH THESE RECORDS!

NOW you can see advance proof that Goodyear's great steel-cable V-Belt will save real money on your toughest drives that "eat up" ordinary belts. It's the performance data on more than 2,000 test sets of this super-tough belt on all types of drives—compiled by the G.T.M. (Goodyear Technical Man) for your information.

In it you'll see evidence that the Goodyear steel-cable V-Belt is successfully operating at belt speeds as slow as 38 F.P.M.—and as fast as 9,400 F.P.M. That it can be used in place of chain-drives, gears or flat belts, in some applications, with far greater efficiency. That it long outlasts conventional belts—that it doesn't stretch—that it withstands heat, shock loads and other severe operating hazards far better. That it gives superior service at lowest ultimate cost!

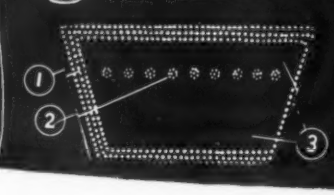
Those are just a few of the reasons why more than *TWO MILLION* of these revolutionary belts are now giving standout service on "killer" drives—both in war plants and on military equipment. Once you have tried them, you will want them on every tough V-drive. To bring the G.T.M. to your office with these convincing records, write Goodyear, Akron 16, Ohio, or Los Angeles 54, California—or phone the nearest Goodyear Industrial Rubber Products Distributor.

E.C. Cord—T.M. The Goodyear Tire & Rubber Company

ASK YOUR G.T.M. TO SHOW YOU THIS SERVICE DATA BOOK ON GOODYEAR STEEL-CABLE V-BELTS

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

G.T.M.-Specified STEEL-CABLE V-BELT for Multi-V drives



1. Heavy, super-tough black cover with uniform friction, longer life
2. Load-carrying, endless, steel cables in neutral plane
3. Tension and compression section of high-quality rubber

GOODYEAR

THE GREATEST NAME IN RUBBER

P.S. For longest wear in cotton cord V-belts, specify Goodyear E. C. Cord Belts.

Strength-Ductility

...AND ITS OVERALL IMPORTANCE IN AN ENGINEERING METAL

In general terms, ductility is the property of a metal that permits it to be deformed without fracture.

It is the exact opposite of brittleness.

If two materials have the same strength and hardness, the one with greater ductility has a good chance of holding up under overloads which would snap the other.

Thus, ductility is especially important in bolts, where strain is likely to result from too vigorous tightening or from abrupt temperature changes. It also is an essential property in metal gaskets. A strong, ductile gasket will adapt itself readily to imperfections in joint surfaces while maintaining the strength necessary to prevent leakage.

And, finally, high ductility is a great advantage in fabrication. The more ductile the material, the more easily it can be handled by the usual cold-working methods... bending, deep drawing, spinning, cold heading.

Strength and Ductility

By the very nature of materials, strength and ductility are divergent properties. As one increases the other decreases. As a general rule, highly ductile metals are soft and weak; some high strength metals are hard and comparatively brittle. But one of the outstanding characteristics of INCO Nickel Alloys is their exceptional combination of strength with high ductility.

How Ductility is measured

There are several methods for testing the ductility of metals, but the most common method is to pull a specimen of the metal on a tensile testing machine until it breaks. The ductility of the metal is then determined by measuring how much the specimen "stretched" or elongated.

This is the method which was used in measuring the strength-ductility of Monel and other metals as shown in the charts below.

What the charts show

In Fig. 1, showing tests made by R. L. Templin and R. G. Sturm, the top point of the curve indicates the tensile strength of the various metals. Ductility... as evidenced by the metal's "stretch"...is shown by the horizontal carry of the curve to the point where it drops off sharply.

Fig. 2 shows the results of strength-ductility tests with ⅜" diameter bolts of Monel, brass, bronze and steel, as determined at Columbia University, New York City. This test shows the high value of Monel for bolts and similar applications.

Spun Monel diaphragms

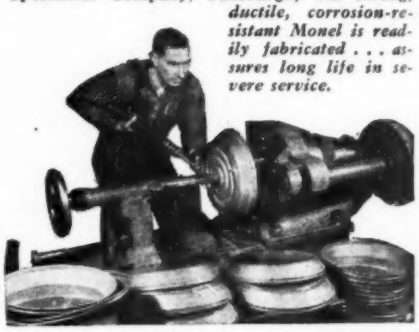
Stronger than mild steel, Monel is ductile enough to be formed in the most severe of all metal working methods... spinning.

Diaphragms for gas meters and gas analysis instruments are spun from Monel, as illustrated in the accompanying photo.

Ductility makes the spinning process easier... the combined strength, hardness and corrosion resistance mean longer life for the finished Monel part.

HIGH-TEMPERATURE HIGH-PRESSURE STEAM *line gaskets formed from Monel by Goetze Gasket & Packing Co. Combined strength-ductility of Monel permits thinner gaskets, saving stress on bolts. Monel gaskets adapt self to joint surfaces... assure strong, tight, lasting seal.*

SPINNING MONEL DIAPHRAGMS *for gas meters and gas analysis instruments at Schwab Specialties Company, Pittsburgh, Pa. Strong, ductile, corrosion-resistant Monel is readily fabricated... assures long life in severe service.*



Gaskets for high temperatures

Typical Monel gaskets for lines carrying steam at high pressures and at temperatures over 500° F. are illustrated also. Since Monel is stronger at 1000° F. than mild steel is at room temperature, thinner and narrower gaskets can be used. Thus, stresses on flange bolts can be reduced considerably. Yet, despite its strength, Monel is so ductile that a gasket shapes itself to slight imperfections in the flange faces as the bolts are tightened, forming a sealed joint that stays tight at high pressures. Alternate heating and cooling do not embrittle Monel gaskets... ductility remains at a high level.

• • •

For further information about ductility and other properties of metals, write for the booklet, "The Technical Editor Speaks." A copy is yours for the asking. Address:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall St., New York 5, N.Y.

TENSILE STRENGTH-DUCTILITY CURVES
FOR SOME METALS AND ALLOYS

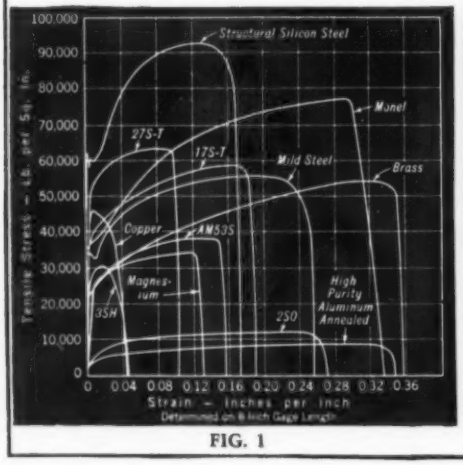


FIG. 1

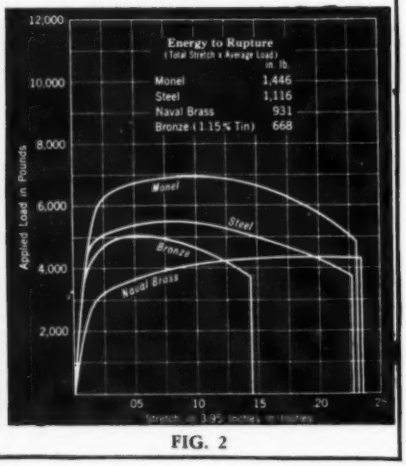
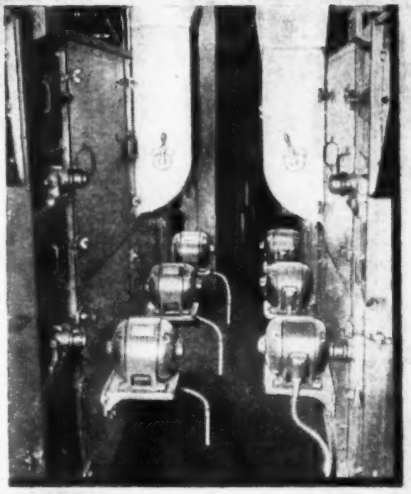


FIG. 2

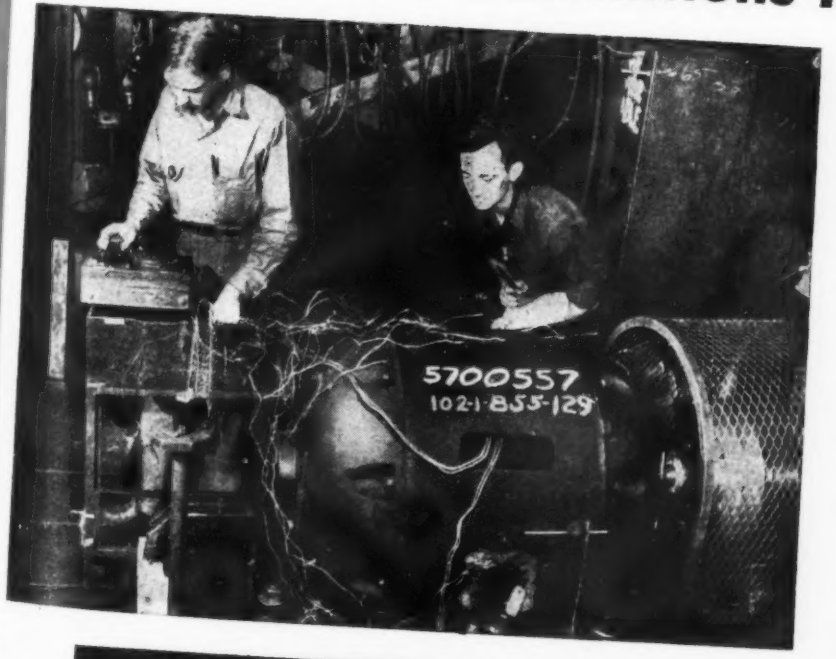
WHEN THE HEAT'S ON

Motor-driven machinery is often called upon to operate under conditions of extreme heat and humidity. For example, the motors on this wool-plant washer must operate in an air temperature of 100° F., with humidity higher than 80 per cent. Conditions like this would shorten the life of any motor lacking effective, performance-tested ventilation design. The double-end cooling system of the Tri-Clad motor helps offset the effects of high ambient temperatures common to heaters, dryers, and many ventilating-fan applications. In addition, motor windings of Formex wire (Class A insulation) are unusually long-lived under total temperatures (ambient plus rise) up to 194 F. For even higher temperatures, Class B insulation offers still greater protection.



G-E Tri-Clad motors applied to Sargent back washers at plant of the Southwell Wool Combing Company, No. Chelmsford, Mass.

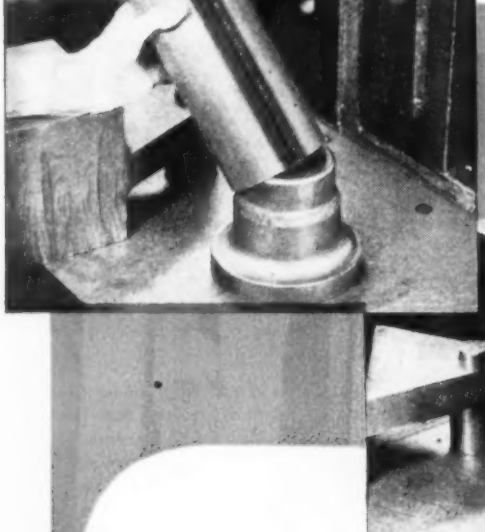
Multi-Point Tests on TRI CLAD Motors Tell Temperature Conditions Inside and Out



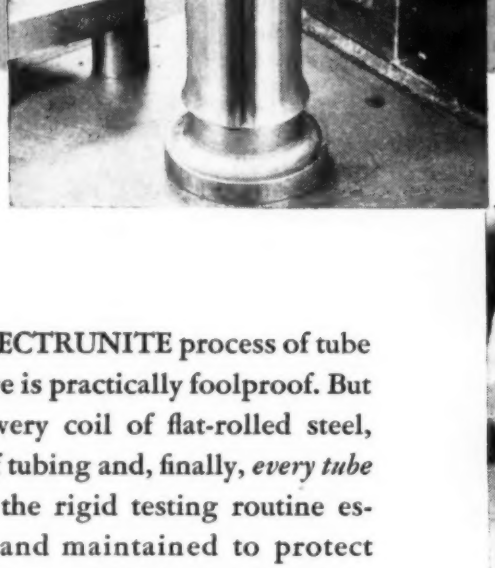
Dozens of thermo-couples and thermometers at all vital points of this Tri-Clad motor reveal temperatures under a wide range of load conditions. First, tests like this helped to perfect the double-end ventilation design. Now regular tests of Tri-Clad motors taken off the production line verify previously established temperature-rise limits, and ability of insulation to stand up. Continued research along the same lines, including operation in enclosures which restrict air flow, points the way to further improvements in the future. *General Electric Company, Schenectady 5, N. Y.*

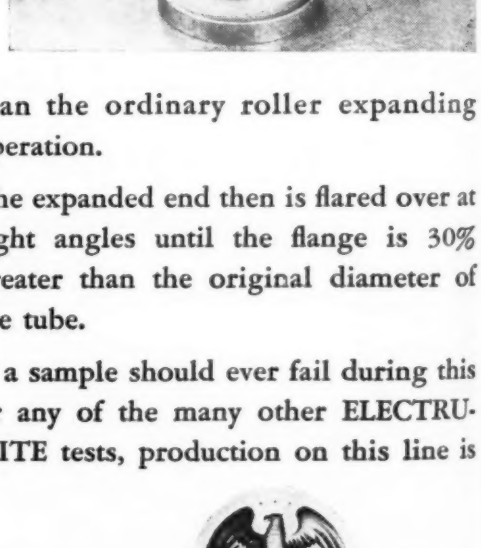
GENERAL ELECTRIC

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.



HOW One





The ELECTRUNITE process of tube manufacture is practically foolproof. But even so, every coil of flat-rolled steel, every lot of tubing and, finally, *every tube* must pass the rigid testing routine established and maintained to protect users of Republic ELECTRUNITE Boiler, Condenser and Heat Exchanger Tubes.

These five photographs illustrate the steps in one test applied to samples taken from every coil of steel as it is welded into tubing.

The samples are expanded over a plug which opens the tube until its diameter is increased ¼" beyond its original diameter—a test considerably more severe than the ordinary roller expanding operation.

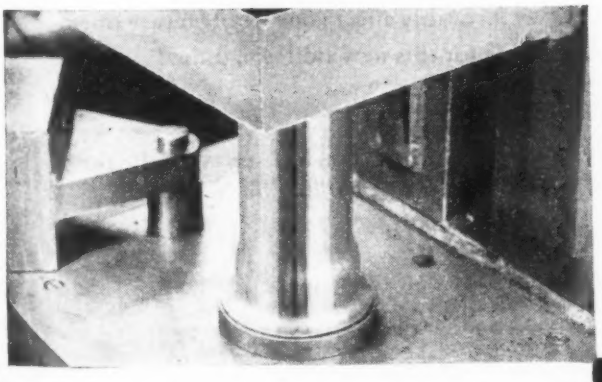
The expanded end then is flared over at right angles until the flange is 30% greater than the original diameter of the tube.

If a sample should ever fail during this or any of the many other ELECTRUNITE tests, production on this line is

Republic
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

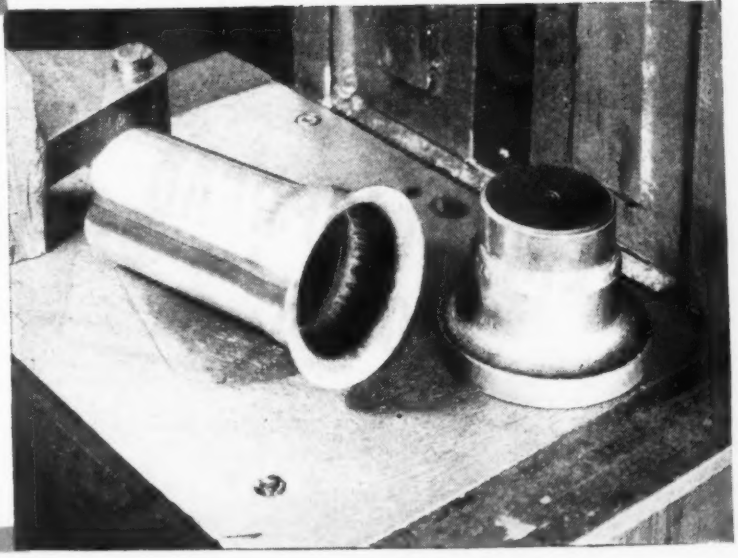
Simple Test

CAN STOP PRODUCTION OF AN ENTIRE BOILER TUBE LINE



stopped immediately and not resumed until the condition causing the difficulty is remedied.

Would you like to know more about these tubes and their records of safety and economy in all types of steam generating and heat transfer equipment? Write us.



REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

What

STOKER STREAMLINING MEANS TO YOU

The days when boiler rooms were noisy "black holes" are past, thanks largely to progress in fuel firing equipment like the Æ Perfect Spread Stoker. This modern, completely automatic stoker is not only streamlined in appearance, but "streamlined" in principle, design and operation.

Its compact, fully-protected mechanism runs quietly and steadily, without clogging. It economically burns all kinds and grades of solid fuel, including by-products and refuse . . . with consistently thorough combustion at a low operating cost.

In plants using steam for power, heating or processing, the Æ Perfect Spread Stoker assures important yearly savings. Be sure to *get the facts* that may favorably affect your whole future operation. Write for this new Bulletin, today!

STREAMLINED—UNDER COVER—QUIET!

The all-enclosed, protected mechanism includes automatic, variable-speed feeder with non-clog safety feature and is accessible without tools for inspection or adjustment by merely lifting cover. Simplified construction, water cooling at vital points, and many other features add up to unusually quiet, efficient operation.

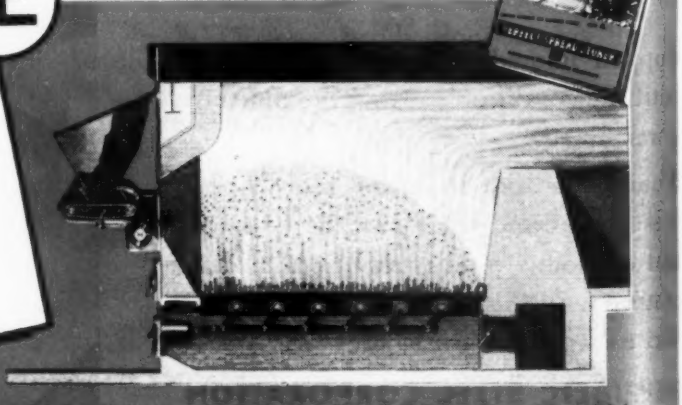
IF YOUR Steam Requirements Call for 175 H. P. up to 200,000 lbs. per hour—

YOU NEED THIS BULLETIN

Write us. 2400 Aramingo Ave., Philadelphia 25, Pa.

Æ

Æ PERFECT SPREAD STOKER



Other Æ Products: Taylor Stokers, La-Bel Hoists, Marine Deck Auxiliaries, Bate-Shaw Fluid Power, Diamond Face Grinders

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PA.

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15 MINUTES ANNOUNCING.

MAY ALTER YOUR POWER OUTLOOK!

The few minutes it will take you to examine the new booklet describing the Improved Æ Taylor Stoker may mean much to you and your company. In it you'll see new features that add years of progress to the design, operation and performance of this time-tested stoker.

You'll see how simplified unit construction reduces installation costs; how the unique continuous ash discharge is automatically timed; how slag formation is minimized; how "finger-tip" ash discharge becomes a reality; how precision feed and better air flow maintain uniformly thorough combustion; how fewer moving, longer wearing parts contribute to lowered steam costs.

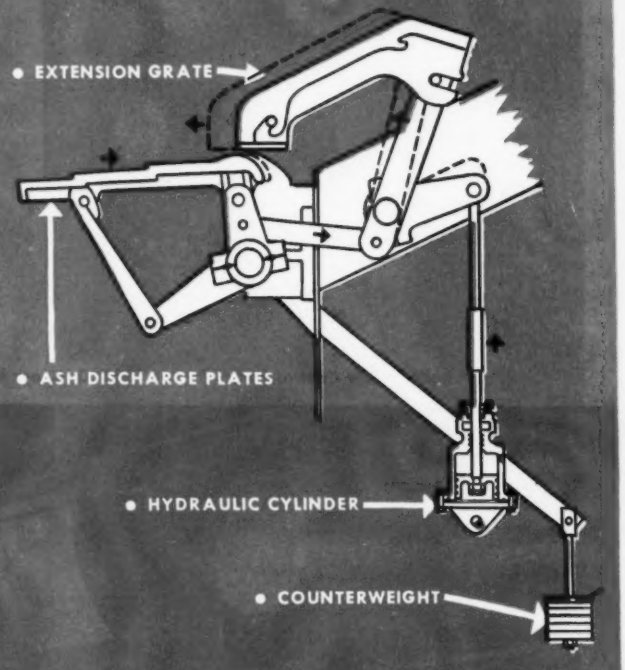
You'll see why these improvements in the Taylor Stoker logically provide even greater efficiencies and economies than previously. Before you decide on *any* equipment take time to send for and study this booklet. It will be time well spent.

IF YOUR Steam Requirements Call for 20,000 to 500,000 lbs. per hour—

YOU NEED THIS BOOKLET

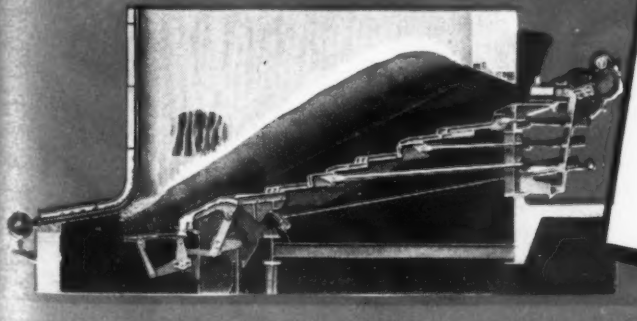
Write us. 2400 Aramingo Avenue, Philadelphia 25, Pa.

ANOTHER IMPROVED FEATURE OF THE TYPE "R" TAYLOR STOKER



Hydraulically driven independent of the main stoker drive, reciprocating discharge plates provide ash movement ALL-THE-WAY TO THE END OF THE STOKER.

Rearward and slightly upward movement of overfeed section effectively moves ash onto the discharge plates. When overfeed section completes rearward travel, continuation of ash movement to point of discharge is assured by rearward travel of discharge plates.



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Æ TAYLOR STOKERS

AIR-COOLED & WATER-COOLED

Other Æ Products: Perfect Spread Stoker, Lo-Hed Hoists, Marine Deck Auxiliaries, Hele-Shaw Fluid Power, Diamond Face Grinders

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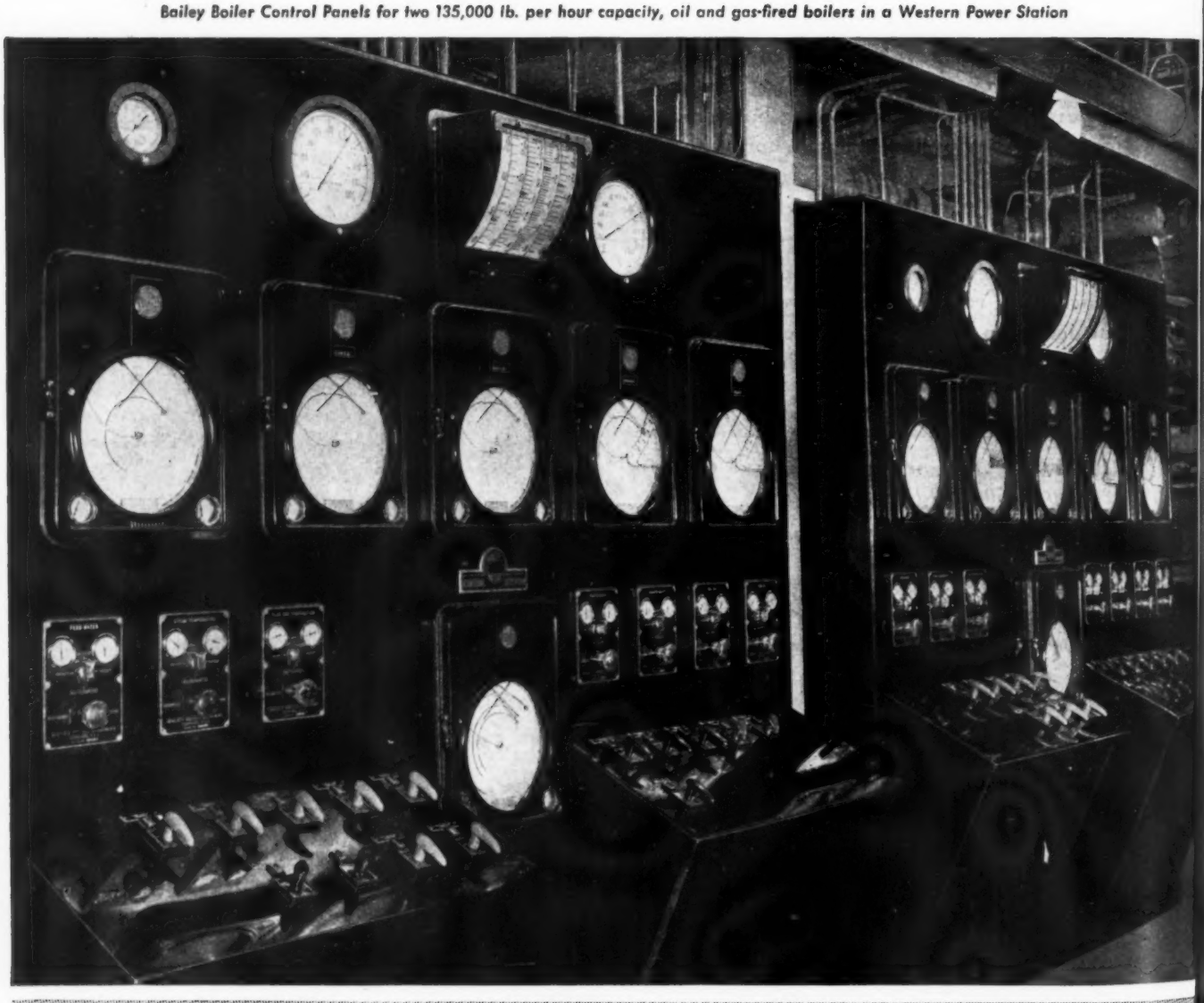
MORE THAN

AND

Bailey Boiler Control Panels for two 135,000 lb. per hour capacity, oil and gas-fired boilers in a Western Power Station



BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHE

METERS

CONTROLLERS

A Bailey Boiler Control System is more than just a group of meters and controllers recording and controlling certain factors in the boiler plant. It is a means of improving plant operation from the standpoints of:—

1. Continuity of service **3. Steaming capacity** **5. Safety**
2. Fuel conservation **4. Conservation of manpower**

Bailey Control Systems are effective because each system is carefully engineered to the requirements of the unit which it serves. The experience gained from thousands of successful combustion control installations serves as a basis for this engineering service which starts with the selection of equipment and continues through the design, construction, calibration, installation and final adjustment on the job.

Engineering work is done in the user's plant by Bailey Field Engineers who have been thoroughly trained in combustion and automatic control practice. These engineers are stationed in over 30 industrial areas throughout the United States and Canada for the purpose of rendering prompt "on the spot" engineering service without undue traveling expense.

The Bailey engineer in your community has a wide background of combustion engineering know-how at his command. It includes the records of tests on thousands of boiler installations covering a wide range of fuels, furnaces and fuel-burning equipment. He has more to offer than meters and controllers. He is primarily interested in helping you to secure optimum operating conditions in your plant.

G-19

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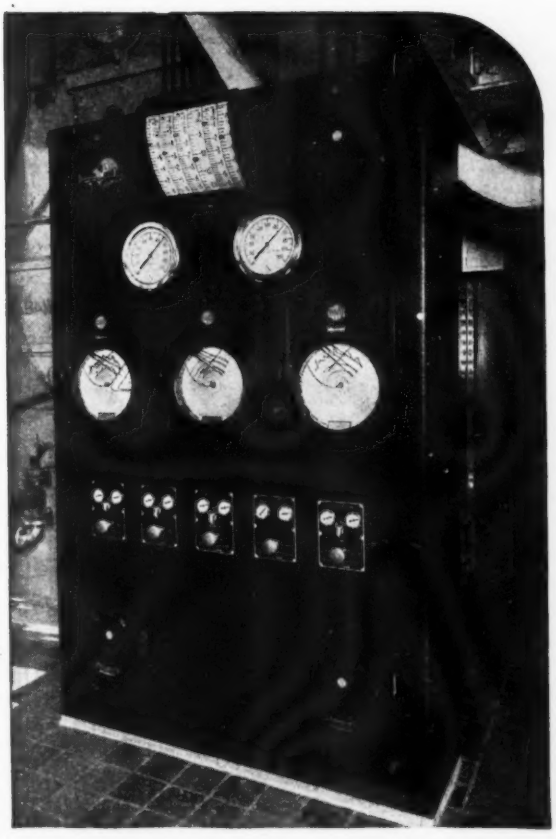
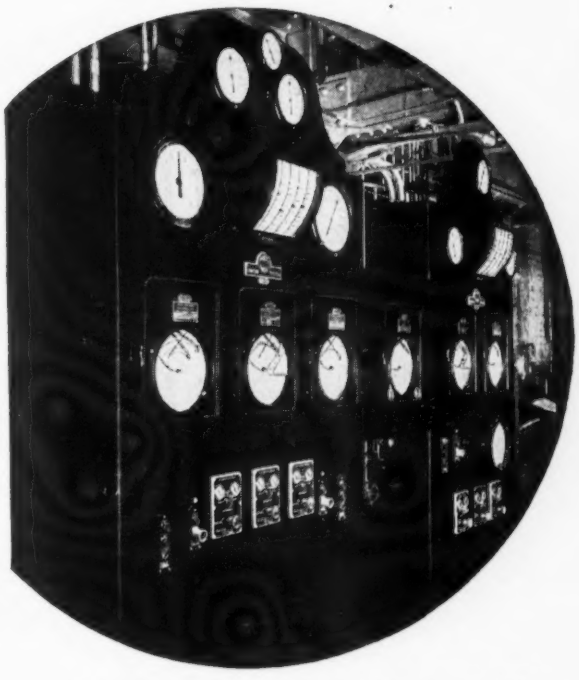
Bailey Meter Company Limited, Montreal, Canada



Bailey Boiler Control Panel for 100,000 lb. per hour capacity Integral-Furnace Boiler

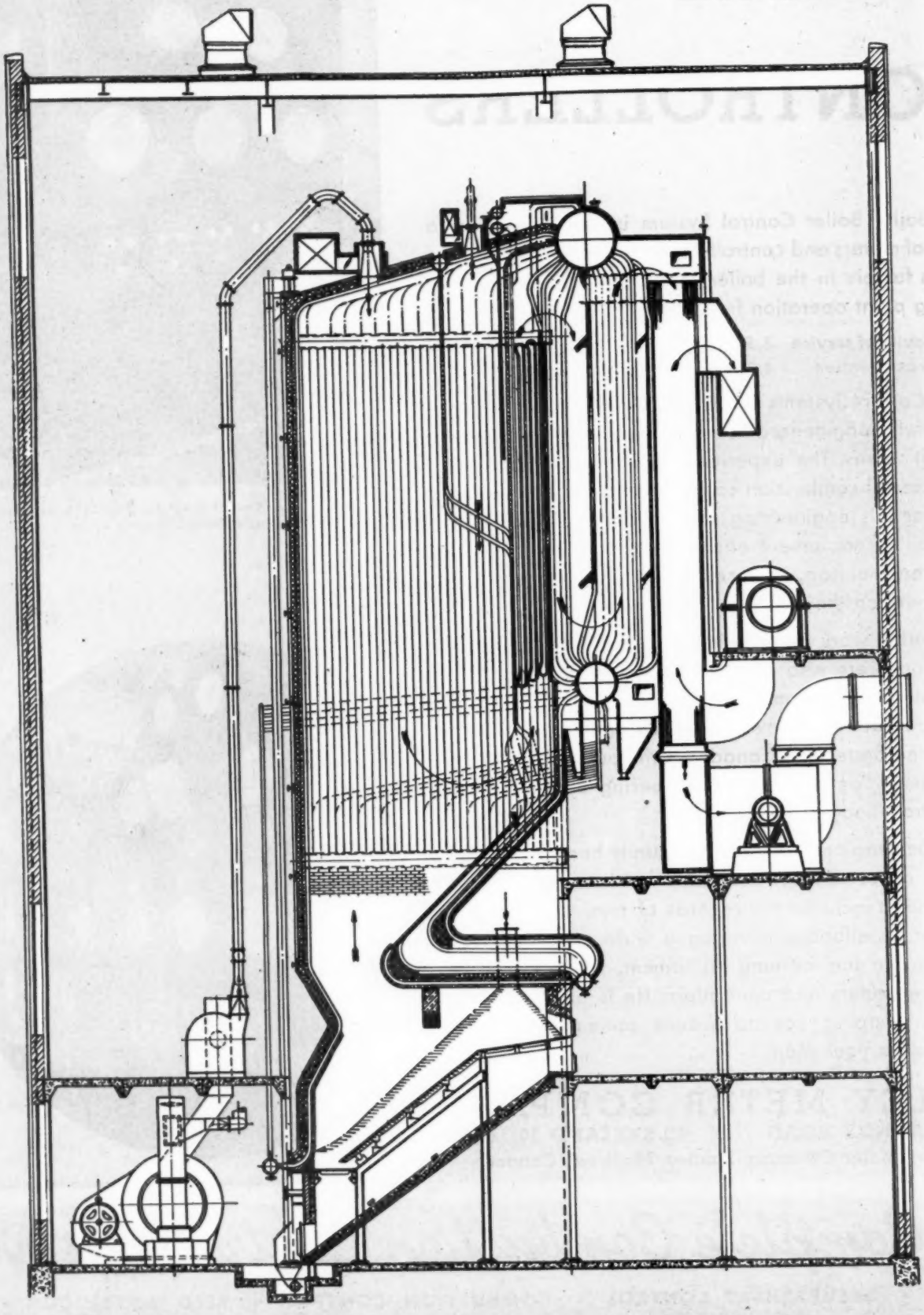


Bailey Boiler Control System in an Eastern Paper Mill

The Complete Combustion Control System

NTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

KVS EQUIPMENT



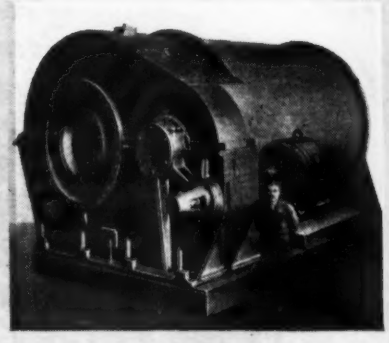
. . . *for* LOW COST STEAM *with* NON-PREMIUM COALS

KENNEDY Van Saun engineering of steam generating plants anticipates the needs of tomorrow by providing wide flexibility in coal selection from available coals and by assuring the maximum return from fuel dollars.

The typical KVS steam generator shown here is of relatively low head for its capacity. It provides a complete water-cooled furnace large enough and of proper design with a dry bottom to burn any kind of non-premium coal. Air preheater is designed into the boiler structure.

This closely-knit, packaged design provides top firing and superheat control, and is unit fired. It is designed to produce any pressure or quantity of steam desired.

All components of this complete steam generator, including pulverizing equipment, are furnished by KVS.



KENNEDY INTEGRAL DRIVE TUBE MILL which pulverizes the hardest grades of abrasive coal to desired fineness at minimum cost for maintenance.

KVS Engineering Service is available for designing and installing complete steam generating plants including pulverizing equipment, burners, fans, coal elevators, bunkers, coal weighing scales, ash conveyors and all necessary equipment. Consult KVS on your requirements and have one responsibility.

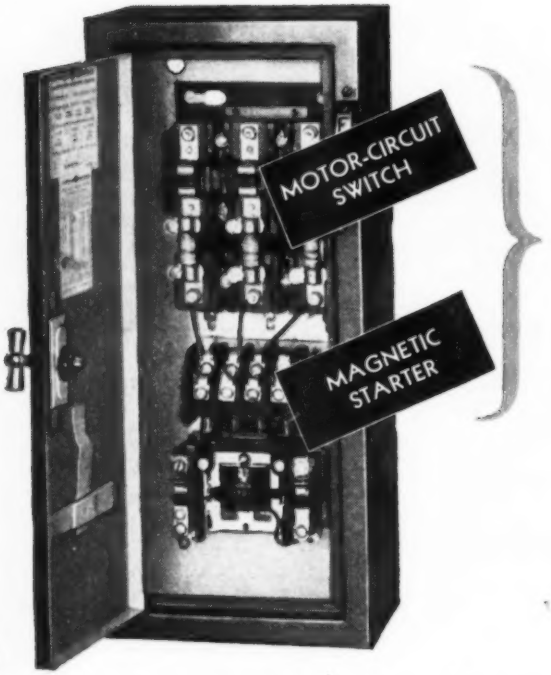
Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.

FACTORIES:
DANVILLE, PA., U. S. A.
CANADA, ENGLAND, AUSTRALIA

MOTOR STARTERS



BOTH IN ONE UNIT

Showing door closed

USE COMBINATION STARTERS
to save time, save space, increase safety

Whatever your plant's operating conditions, you can get a combination control to fit it. This means a motor-circuit switch (with short-circuit protection) and a magnetic starter—in one, compact, easy-to-mount unit.

Here are some of the advantages

1. *50% reduction in mounting time*—You mount only one device, not two.
2. *40% reduction in wiring time*—Connect to only 9 terminals, not 15. The switch and starter come already connected.
3. *Increased safety*—Cover cannot be opened while there is power on the starter.
4. *Reliable motor protection*—Protection devices co-ordinated in starter at the factory.
5. *Saving of wall space*—The one device takes less space than two.
6. *Improved plant appearance*—Single, streamlined case—less open wiring and conduit.

GENERAL ELECTRIC

EVERY TYPE, EVERY KIND, FOR EVERY MACHINE APPLICATION

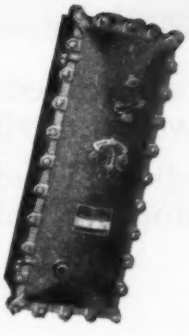
DEPENDABLE... ATTRACTIVE IN APPEARANCE... DESIGNED TO BLEND WITH MODERN MACHINES

DUST-TIGHT ENCLOSURES—For use in steel mills, cement mills, and other locations where the dust content of the atmosphere is heavy. The case is of heavy sheet metal, equipped with heavy gaskets, clamping bolts, and wing nuts.

GENERAL-PURPOSE STARTERS—Suitable for general-purpose, indoor applications where atmospheric conditions are normal.

WATERTIGHT ENCLOSURES—Suitable for outdoor use, and for damp places indoors, such as dairies, breweries, and ship docks. The case is of cast iron, or fabricated steel plate, with a special weatherproof finish and corrosion-proof fittings.

CORROSION-RESISTANT CONTROLLERS—Made in two forms—one for corrosive atmosphere and one for hazardous locations. All arcing parts and terminals (of forms for hazardous locations) are at least six inches under oil.



STARTERS FOR HAZARDOUS LOCATIONS—Made of cast, high-strength alloy. This starter is designed to withstand internal explosions. The flanges, which are securely bolted on all sides, are ground to tolerances which will not permit the escape of gases. General Electric Company, Schenectady 5, N. Y.

Which of these bulletins may we send you?

General Electric Company, Section J676-132,
Schenectady 5, New York.

Please send me the bulletins checked below.

- ☐ GEA-3715 General-purpose, dust-tight and watertight starters
- ☐ GEA-3541 Corrosion-resistant controllers
- ☐ GEA-3804 Starters for hazardous locations

Name.....

Company.....

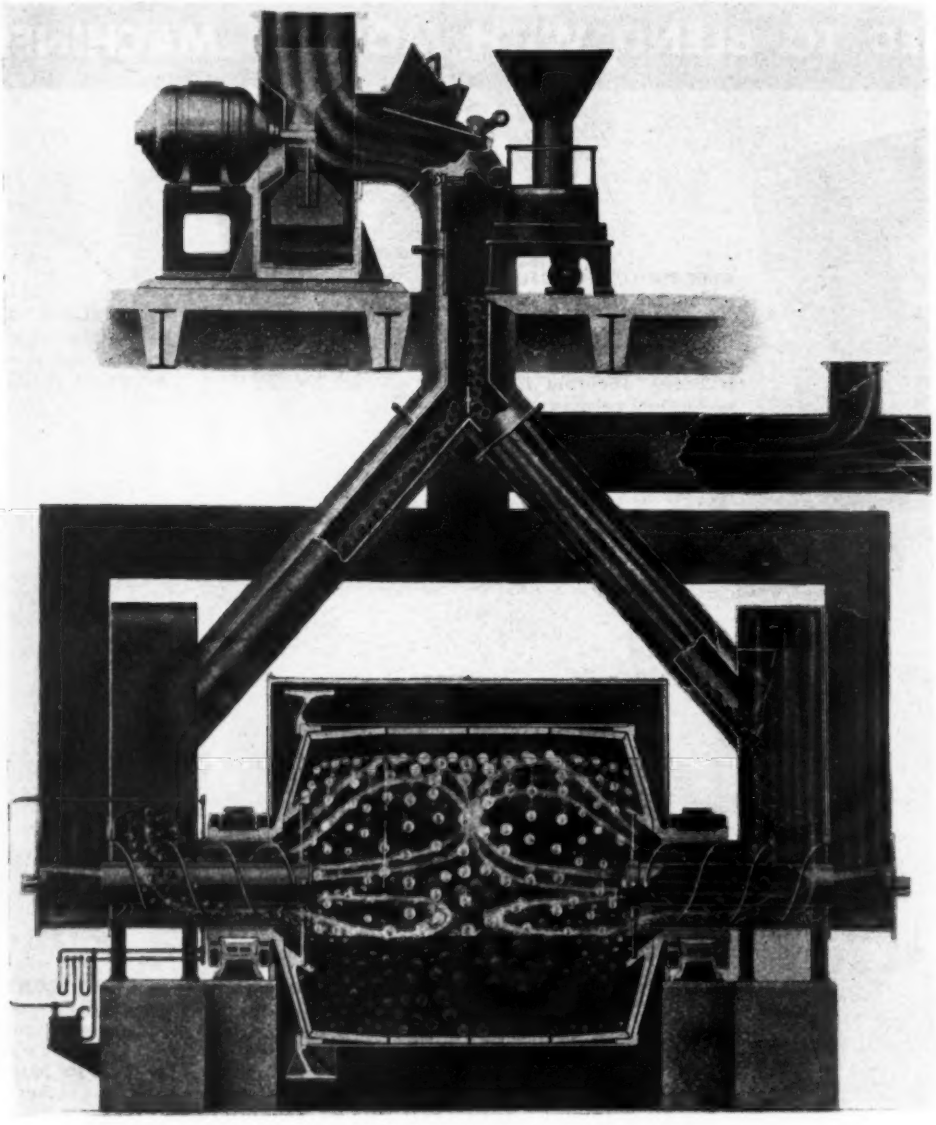
Address.....

City.....State.....

8920

Buy all the BONDS you can—and keep all you buy

Continuous FINE GRINDING



Fine grinding and Full Capacity are obtained without dependence on close clearances between moving parts.

New Ball charge (the grinding medium) is added during operation as necessary, thus eliminating shut-downs to replace the pulverizing parts.

FW **FOSTER**

# of PULVERIZED FUEL GIVES HIGH BOILER EFFICIENCY

The outstanding performance characteristic of Foster Wheeler (Hardinge type) Ball Pulverizers is maintenance of high fineness in the pulverized fuel—over long periods of service without loss in capacity.

This exceptional ability to operate without reduction in fineness or forced outage, effects material savings including:

1. Boiler efficiency maintained for duration of run with resultant low cost for fuel.

2. Boiler outages for cleaning heating surfaces reduced; pulverizer repairs minimized.

3. Labor charges against cleaning boiler and water wall surfaces sharply decreased.

FOSTER WHEELER CORPORATION, 165 Broadway, New York 6, N. Y.

WHEELER FW

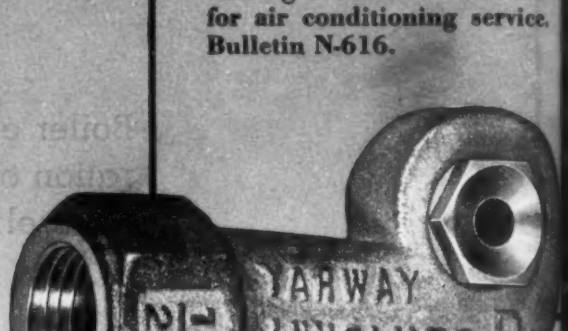
THERE'S

"IMPULSE"

The Yarway Impulse Steam Trap has only one moving part; no buckets, bellows, levers or floats. Bulletin T-1739.

"INVOLUTE"

The Yarway Involute Spray Nozzle is non-clogging, trouble-free. No internal parts; contour of body guides flow in an involute path. For cooling condenser water and for air conditioning service. Bulletin N-616.



"GUN-PAKT"

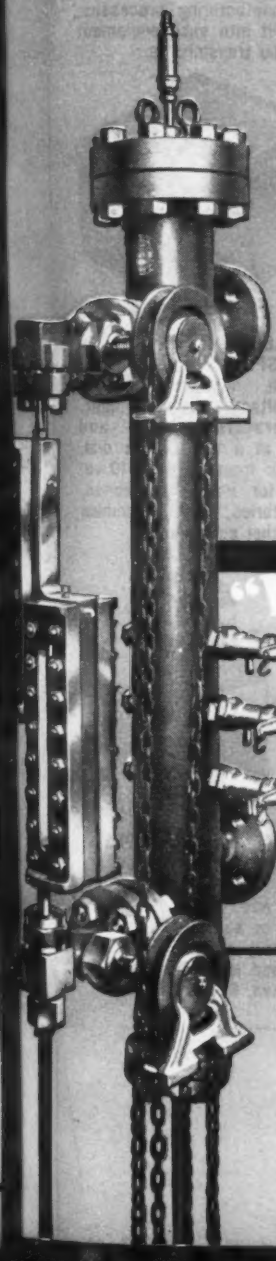
The Yarway Gun-Pakt Expansion Joint may be re-packed under full steam pressure and never needs unpacking. Bulletin EJ-1909.

YARWAY

A Reason..

ALL these Yarway Steam Specialties have become outstanding successes because of unique Yarway engineering principles. That's why so many plant operators say, "Yarway is our way" when selecting such equipment.

YARNALL-WARING COMPANY
100 Mermaid Ave. Phila. 18, Pa.



"FLOATLESS"

The Yarway Floatless Water Column operates with balanced solid weights, on the well-known displacement principle. Bulletin WG-1809.

"SEATLESS"

The Yarway Seatless Blow-Off Valve has no seat to score, wear and clog with mud, scale and dirt. Write for Catalog Section B-424 for pressures to 400 lb, Section B-431 for pressures from 400 to 2500 lb.

STEAM SPECIALTIES

SEE HOW THIS COMPANY BROUGHT THE RIGHT VOLTAGE TO THE JOB

SHOWS VERSATILITY OF SMALL G-E DRY-TYPE TRANSFORMERS

The unique sling-mounted power supply shown above was fabricated by the Permanente Metals Corporation, Richmond, Calif., Shipyard No. 2. As many as three of these units are placed at strategic points on the upper deck of a ship abuilding to provide a convenient source of power for portable blowers, tools, and lighting. They operate from a nominal 480-volt, three-phase supply.

Each unit consists of three G-E single-phase, 25-kva, dry-type transformers which form a three-phase bank, connected delta primary and wye secondary. This hook-up steps down the 480-volt supply to 208 volts three-phase, or 120 volts, line-to-neutral, single-phase—a time-saving application of in-stock, standard transformers to perform a special job.

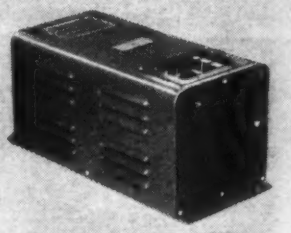
These transformers (Type D) are of the same construction being used, profitably, from coast-to-coast on secondary circuits in industrial plants. They provide the right voltage for the most economical operation of a wide variety of electric equipment. As they don't require fireproof vaults, they can be installed right next to the load, thus avoiding long runs of expensive copper. Their small size, light weight, and compactness make them easy to install on the floor, on the wall—anywhere you wish.

They are available in ratings up to and including 100 kva, 600 volts and below. For further information, ask for Bulletin GEA-897. *General Electric Company, Schenectady 5, N. Y.*

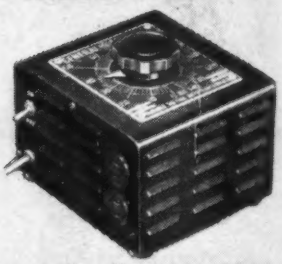
A FEW OF THE MANY PURPOSES FOR WHICH YOU CAN USE TYPE D TRANSFORMERS TO ADVANTAGE:

- To insulate lighting circuits from power circuits
- To boost low line voltage to improve equipment performance
- To reduce light flicker caused by motor starting, etc.
- To supply correct voltage for the most efficient operation of motors, machine tools, welding apparatus, etc.

OTHER G-E AIDS TO BETTER VOLTAGE



VOLTAGE STABILIZER—Automatically provides a constant 115-volt supply to a given load, on circuits varying from 95 to 130 volts. Ratings from 50 to 5000 va. Ideal for precision laboratory or manufacturing processes, or built into such equipment as radio transmitters.



VARIABLE-VOLTAGE AUTO-TRANSFORMER—Provides smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243 to 810 va. Ideal for use in factories, laboratories, and assembled with other equipment.

AIR-COOLED REGULATORS—Automatic type: for secondary circuits (10% regulation, raise and lower). Remote-motor or hand operated: for laboratory or testing (100% raise and lower). Ratings up to 12 kva, 600 volts.

GENERAL ELECTRIC

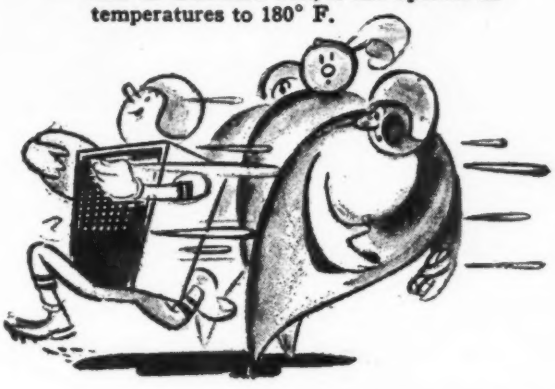
THE RIGHT VOLTAGE AT THE RIGHT PLACE DOES THE JOB BETTER

HERE'S ALLIS-CHALMERS' GREAT NEW V-Belt Team!

ALLIS-CHALMERS recommendations for belt selections are unbiased . . . because Texrope's V-belt lineup is *complete.* And as inventor of the multiple V-belt drive, A-C offers sound engineering help . . . backed by the world's longest experience in giving industry money-saving drives.

1 **HEAT-RESISTING SUPER-7** has ability to withstand high ambient built right into it. Standard belt, it can operate in temperatures to 180° F.

2 **OIL-RESISTING SUPER-7** is right for drives where fairly bad oil conditions prevail. Neoprene-covered, it resists oil spray and grease.



3 **OIL-PROOF SUPER-7,** is solid Neoprene—a synthetic unaffected by most rubber attacking liquids. Recommended for *extreme* oil conditions.

4 **STATIC-RESISTING SUPER-7** *conducts* static charge to machine for grounding charge. This safety belt is applied where explosion danger exists.

5 **SUPER-7-STEEL** employs endless steel cables to provide greater strength, reduce belt stretch. It is ideal for driving extra-heavy loads.

A 1732

IT PAYS TO MAKE ALLIS-CHALMERS YOUR V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

CONSERVE FUEL
and lower your steam cost

Are your boilers delivering the amount of steam you are paying for—or are you being short-changed? An automatic combustion control system, as designed and built by Republic, will enable you to operate your boiler (or boilers) over long periods at *test efficiencies* regardless of variations in fuel, load and other operating factors.

The Republic combustion control is a unified system controlling simultaneously, in measured quantities and in correct proportions, the fuel and air input to the boiler. It increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency. It not only checks operation but automatically makes necessary corrections of individual factors before faulty operation has a chance to develop.

The difference between such a control and an assembly of uncoordinated regulating devices is comparatively small in equipment but great in principle. Merely to provide automatic operation of a number of individual devices is not enough.

CHECK THESE FEATURES

Built into the Republic combustion control systems are many features that enable it to fulfill all the conditions of theoretically perfect combustion control and still meet all the demands of every-day operation.

Check the following features against your list of "musts" for a perfect combustion control system.

√ CENTRALIZED CONTROL: The operation and control of the boiler or boilers is centralized at the master controller.

√ FUEL-AIR RATIO INDICATOR: The master controller is provided with mercury manometers which indicate the measured fuel and air inputs to the boiler and the fuel-air ratio.

√ FUEL-AIR RATIO ADJUSTMENT: A handwheel on the front of the master control panel provides a convenient means for adjusting the fuel-air ratio.

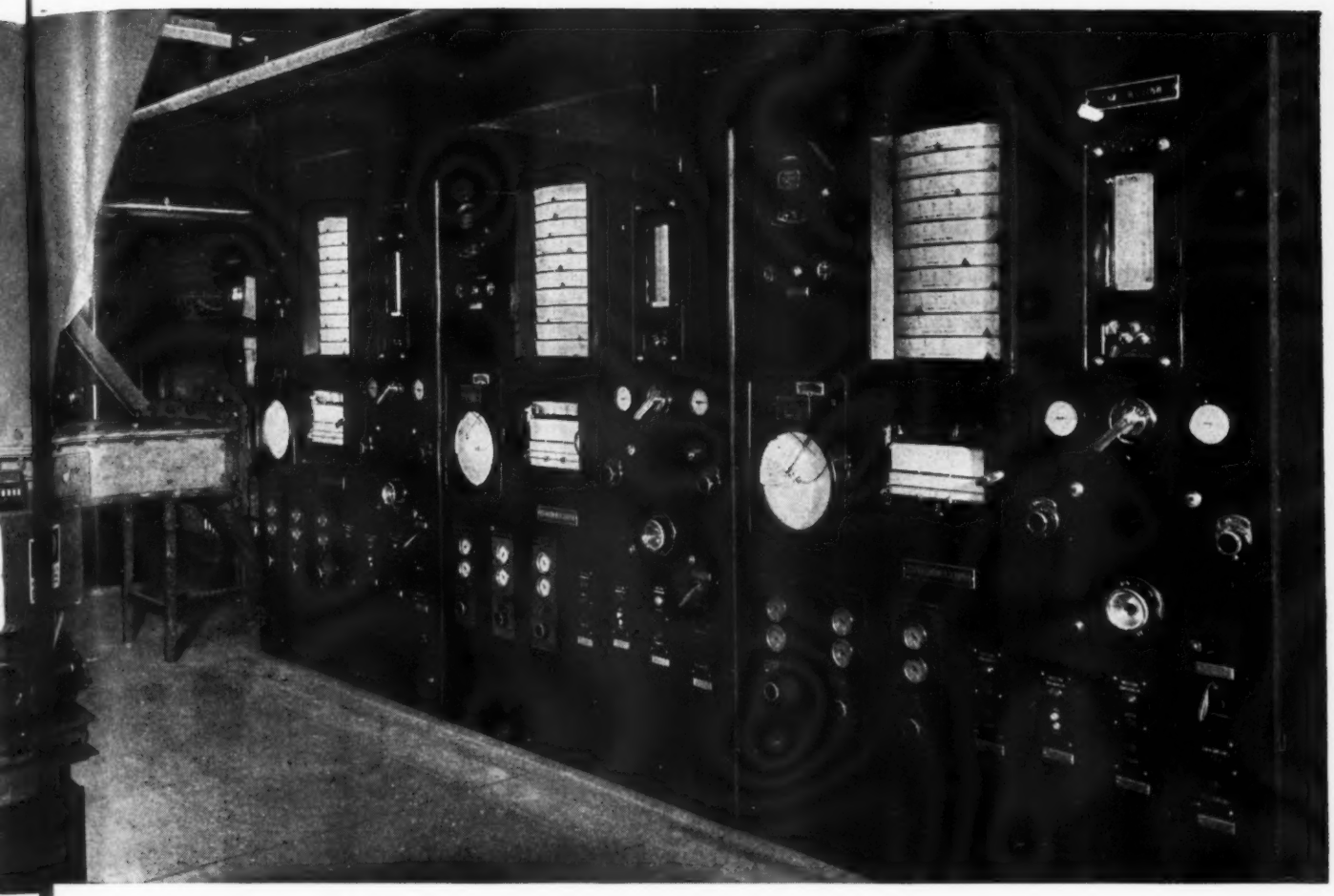
√ ALL BOILER RATINGS: Maintains proper fuel-air ratio over the entire range of boiler ratings.

√ CONSTANT STEAM PRESSURE: Maintains the plant steam pressure within narrow limits of variation by proportioning the fuel and air inputs to the load.

√ LOAD DISTRIBUTION: Provides a means of distributing the load among the boilers as desired.

√ MANUAL CONTROL: Boiler ratings can be controlled manually by a handwheel located on the front of the panel.

REPUBLIC
INSTRUMENTS
AND CONTROLS



PERFORMANCE FACTS

Here is a list of installation reports, available to you, which present detailed evidence of the savings derived from the installation of Republic automatic combustion control systems in typical boiler plants.

Installation Report No. 43-39
RCA MFG. CO.: 2-125,000 lb. per hr. boilers; 850 lb. pressure, 750 F; pulverized coal or oil fired.

Installation Report No. 51-40
CLINTON COTTON MILLS: 1-70,000 lb. per hr. boiler; 415 lb. pressure, 725 F; pulverized coal fired.

Installation Report No. 60-39
TIMKEN ROLLER BEARING CO.: 1-60,000 lb. per hr. boiler; 400 lb. pressure, 630 F; underfeed stoker fired.

Installation Report No. 70-39
KREY PACKING CO.: 2-35,000 lb. per hr. boilers; 330 lb. pressure; chain grate stoker fired.

Installation Report No. 31-40
SUTHERLAND PAPER CO.: 3-50,000 lb. per hr. and 2-81,000 lb. per hr. boilers; 175 lb. pressure, 450 F; spreader stoker fired.

Installation Report No. 41-40
GODCHAUX SUGARS, INC.: 1-100,000 lb. per hr. boiler; 450 lb. pressure, 560 F; natural gas fired.

Installation Report No. 61-39
WORCESTER SALT CO.: 1-125,000 lb. per hr. boiler; 200 lb. pressure, 400 F; natural gas or pulverized coal fired.

Installation Report No. 120-39
SWIFT & CO.: 2-45,000 lb. per hr. boilers; fuel oil fired.

All these reports are included in Data Book No. S-21. Write for your copy today. We will gladly mail it to you without obligation.

Republic Flow Meters Co.

Riqid *TESTS* at every

TEST PRESSURES FAR EXCEED RATED PRESSURES

Every Lunkenheimer valve is given a thorough test at pressures far above its rated working pressure. Valves are tested on both sides at high and low pressure for seat tightness, and then given a shell test. The slightest leak causes rejection.

EVERYTHING MUST BE RIGHT. . . OR IT IS ALL WRONG

In final inspection, after testing, every minute detail is scrutinized, even to the appearance of the finish of the valve. We have just one aim—100% perfection.

Fig. 2125
125 lb. S. P. Bronze Gate
Double Disc, Rising Stem

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.

vital step in production

quard the dependable *QUALITY* of LUNKENHEIMER VALVES

Nothing is left to chance in producing Lunkenheimer Valves. Exacting tests with the most advanced modern equipment are made at each important point in manufacture. Even final packaging for shipment must meet rigid specifications!

This may be producing valves the "hard way" . . . but for Lunkenheimer it's the *right* way, since it safeguards a reputation for quality that is our proudest possession.

Today, with greatly stepped up production schedules, maintenance men appreciate more than ever the rugged durability, efficiency, and longer service life of Lunkenheimer Valves—the less attention and fewer repairs they require.

Lunkenheimer Distributors are located in all important industrial centers. There is one near you, ready at all times to assist in solving your problems of maintenance and operation.

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO, U.S.A.
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 7
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

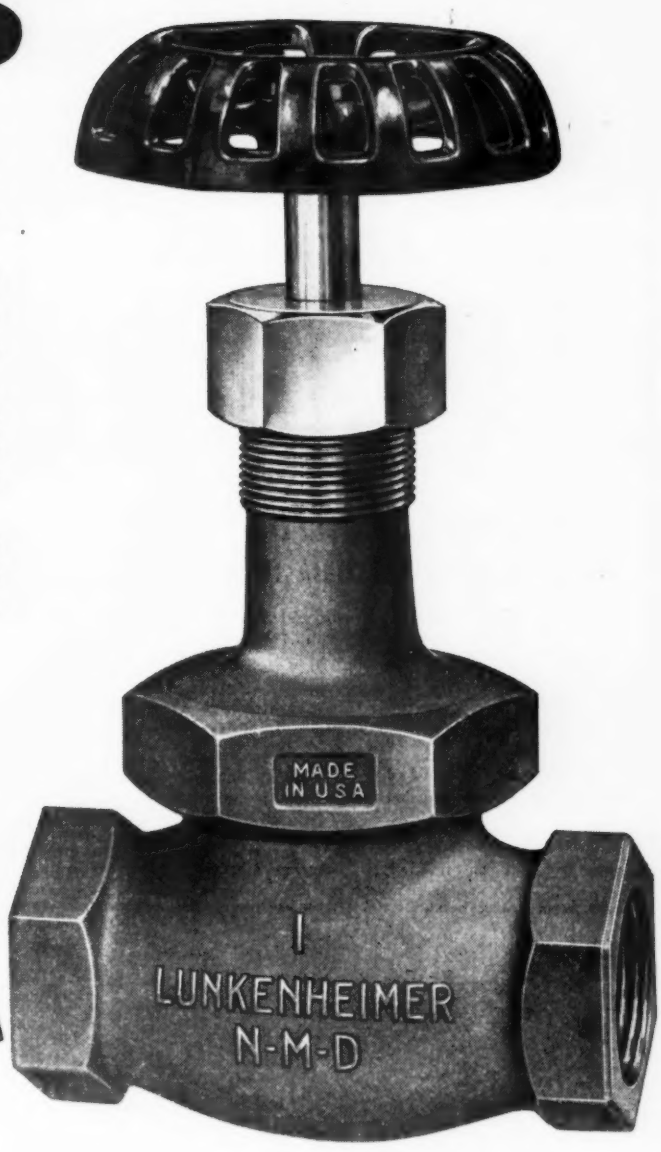
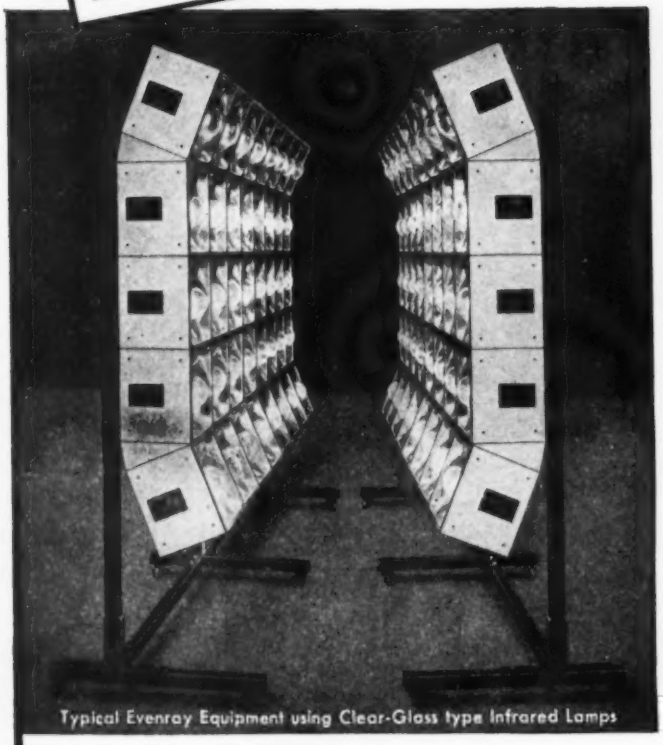


Fig. 123
"N-M-D" Globe (Non-Metallic Disc)

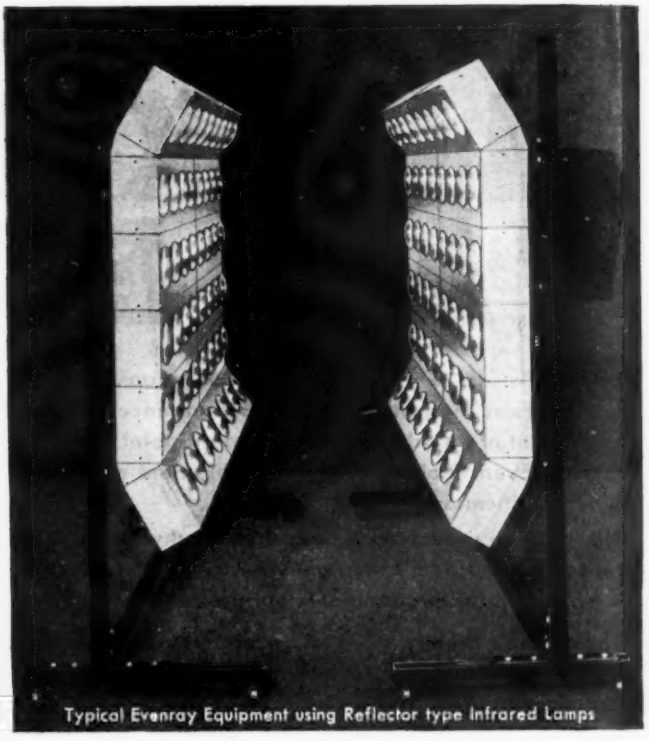
BOILER MOUNTINGS - - - LUBRICATING DEVICES - - - AIRCRAFT FITTINGS

*Highest Efficiency in the Utilization of INFRARED RADIANT ENERGY

The FOSTORIA
For BAKING–DRYING–



Typical Evenray Equipment using Clear-Glass type Infrared Lamps



Typical Evenray Equipment using Reflector type Infrared Lamps

INDUSTRIAL BENEFITS
OF OVER 3,000 FOSTORIA INSTALLATIONS

Saves Time The speed with which heat is transferred by the Evenray System, reduces processing time in many instances from hours to minutes.

Saves Floor Space The Evenray System provides more production per square foot of floor space.

Reduces Rejects The Evenray System processes all pieces under identical conditions with positive control.

Instant Production The Evenray System may be turned on and off as needed. Operation starts and stops instantly.

No Stand-by Loss The Evenray System requires no warm-up waiting period. There are no production delays and loss of manpower time.

Visible Operation The Evenray System permits continuous inspection of materials being processed.

Greater Flexibility A variety of materials may be processed with the same Evenray System equipment. The Infrared sources may be utilized in group combinations as required.

Economical Operation The highly efficient utilization of power gives lower energy cost per piece processed.

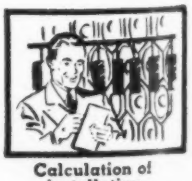
Worker Comfort The Evenray System affords better working conditions. No excessive warmth around the equipment. Easy ventilation of any processing odors. Fine appearance and clean operation. Safety and comfort for workers.

EVENRAY SYSTEM
fostoria
FOR BAKING • DRYING • PREHEATING • DEHYDRATING

Trade Mark
Reg. U. S Pat. Off.

FOSTORIA
Specialists in

Study of problem and pretesting for solution



Calculation of installation required

Evenray SYSTEM*

DEHYDRATING – PREHEATING

New in industrial applications only a few years ago, Infrared Radiant Energy is now utilized by thousands of plants to speed and improve production. The rapid employment of this modern technique of heat application is due in large part to the efficient equipment development and progressive research in a wide scope of applications by Fostoria.

Two factors are vital to the successful utilization of Infrared Radiant Energy—

Properly designed equipment to house the Infrared sources so that the energy is collected and distributed most efficiently. Experienced technical analysis of the application to determine the proper utilization of equipment and accurately forecast production results.

The Fostoria Evenray System provides equipment for the accommodation of energy sources in *either* clear-glass types or reflector types as is determined best for the specific application.

Reflecting surfaces of the equipment are gold plated — the most efficient reflecting medium for Infrared Radiant Energy. Housing units, which provide wide flexibility of assembly into any tunnel contour and size required, give closed construction to shield the material in process from cold drafts and dust. Source sockets are protected from heat rays and all wiring is enclosed in channels conforming to Underwriter's Laboratories specifications. These and other vital features assure the maximum of operating efficiency, easy adaption to production lines, and low maintenance cost.

Fostoria Industrial Service provides the experience of over 3,000 installations and the comprehensive technical facilities to analyze and pre-test the specific advantages of Infrared Radiant Energy for any industrial application. Your baking, drying, dehydrating or preheating problem in the hands of a Fostoria Specialist will receive expert attention and the "know-how" recommendation for sound engineering solution.

REQUEST THIS FREE BOOKLET, TODAY

Write, today, for this factual information on Infrared Radiant Energy and its economical utilization for faster and better production with the Evenray System.

Case history information applicable to your operations will be included if you send us general facts about your baking, drying, dehydrating or preheating problem.

SERVICE CENTERS
Located in Major Industrial Centers

ATLANTA
140 MARIETTA ST., N. W.
MAIN 2757

BOSTON
620 COMMONWEALTH AVE.
COMMONWEALTH 0333

BUFFALO
404 NORTH OAK ST.
LAFAYETTE 8135

CHATTANOOGA
1021 CHESTNUT ST.
PHONE 6-6194

CHICAGO
747 W. JACKSON BLVD.
RANDOLPH 5942

CLEVELAND
4500 EUCLID AVE.
ENDICOTT 6622

DAYTON
334 WAYNE ST.
FULTON 3594

DETROIT
12171 GRAND RIVER AVE.
HOGARTH 1850

INDIANAPOLIS
548 MASSACHUSETTS AVE.
RILEY 2934

LOS ANGELES
1206 MAPLE AVE.
PROSPECT 7611

MILWAUKEE
104 EAST MASON ST.
DALY 2949

MINNEAPOLIS
2 FOSHAY TOWER
ATLANTIC 7363

NEW HAVEN
(HAMDEN, CONN.)
1240 WHITNEY AVE.
PHONE 2-5985

NEW YORK
92 WARREN ST.
WORTH 2-3352

OMAHA
1102 FARNAM ST.
ATLANTIC 5540

PHILADELPHIA
(BALA-CYNWD, PA.)
349 MONTGOMERY AVE.
GREENWOOD 4477

PITTSBURGH
5339 PENN AVE.
HIGHLAND 9900

ST. LOUIS
1706 OLIVE ST.
CENTRAL 0153

SAN FRANCISCO
419-425 TENTH ST.
HEMLOCK 7611

SEATTLE
90 DEARBORN ST.
MAIN 0919

CANADA
NORTHERN ELECTRIC CO., LTD.
MONTREAL TORONTO

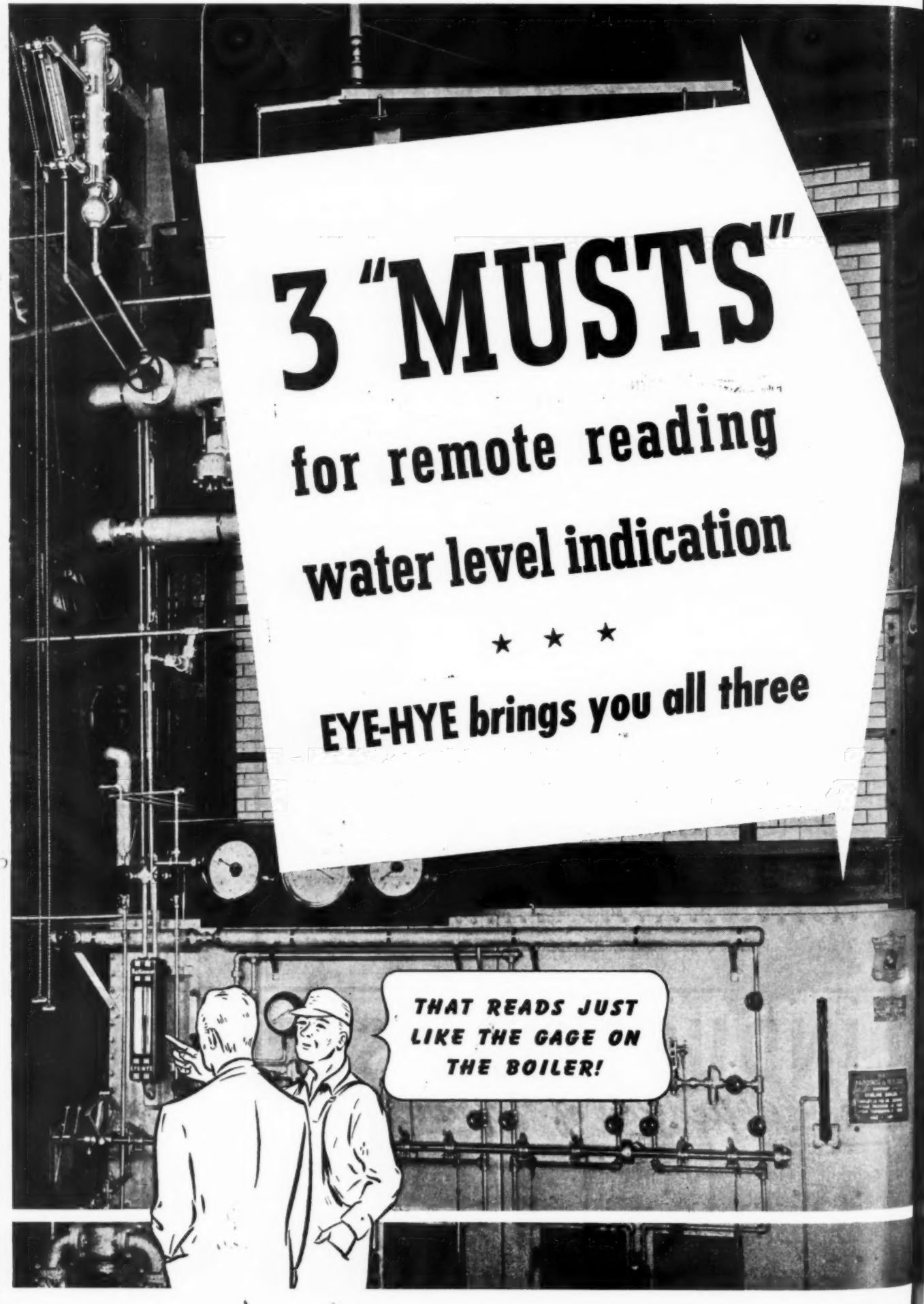
INDUSTRIAL SERVICE
the Application of Infrared Radiant Energy

Supervision of Installation

After-installation service

FACTORY AND GENERAL OFFICES
FOSTORIA, OHIO

Independently Affiliated Manufacturers:
Southern Industries, Inc. Atlanta, Ga. — *Newmac Company San Francisco, Calif.* — *Amalgamated Elec. Corp. Ltd. Toronto, Canada*


3 "MUSTS"
for remote reading
water level indication
★ ★ ★
EYE-HYE brings you all three
THAT READS JUST LIKE THE GAGE ON THE BOILER!

1 Accuracy

EYE-HYE *accuracy* is in large measure due to its use of the scientific U-tube manometer principle. Actuation is from the Reliance patented Unitemp which compensates for temperature variation throughout the indication range. Provision for blowdown insures free movement of hydrostatic force. Factory calibration for the specific gravity of the water in *your* boiler guarantees perfect measurement without further adjustment.

2 Dependability

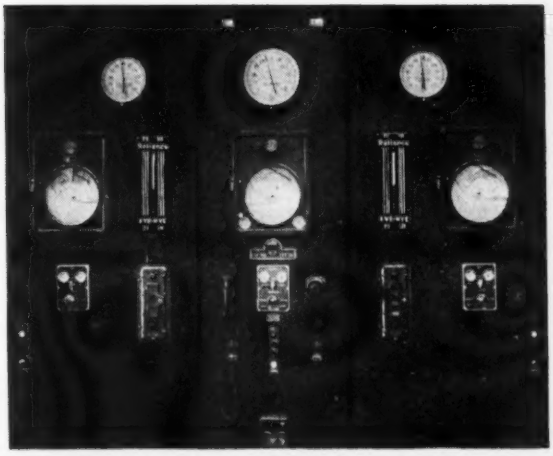
EYE-HYE is *dependable* because of its positive hydrostatic operation—a constant means in itself of checking whether the gage is functioning. With no *mechanical* parts to wear, adjust or get out of order, EYE-HYE's one "moving part" is its one special indicating fluid. Over 5000 EYE-HYEs faithfully help engineers now in stationary and marine power plants to avoid the dangers of uncertain or inaccurate readings.

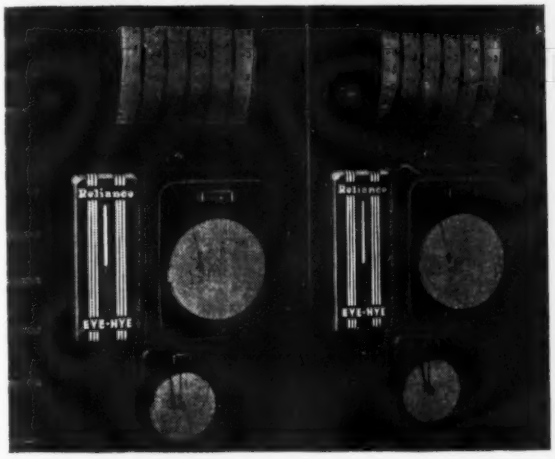
3 Clear Indication

EYE-HYE reads like water gages you've always known —only it's close by, down at eye level. Sharp and clear, the illuminated green indicating fluid rises and falls in direct proportion to the conventional drum gage. No mental "gear shifting" necessary to interpret the reading, for you instantly *know* its meaning, like the familiar column of liquid in the gage above.

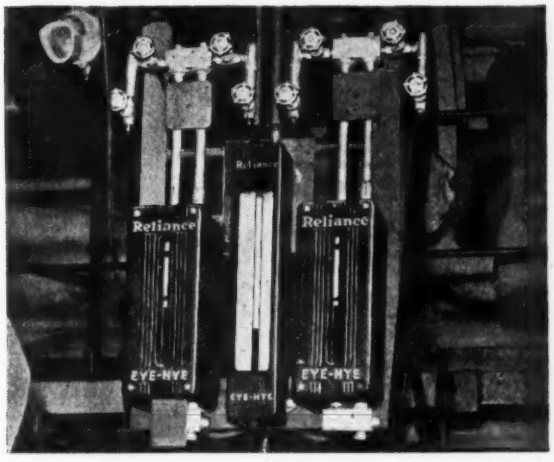
Easy to install, use and maintain, EYE-HYE brings water level reading where you want it—any reasonable distance from the drum—even *above* it if desired. Its convenient placement on wall or panel board forces more frequent attention to water level performance—protects you and your power plant from the danger and expense of water level accidents.

Plan ahead—investigate now the possibilities of increasing the efficiency and safety of your water level supervision, with EYE-HYE. Write for Bulletin 382-C.





Modern industrial and central station power plants install EYE-HYE on panel boards — the proper meeting place for all indicators. EYE-HYEs are made for all pressures to 2000 lbs.



The roll and pitch of ship service means nothing to the accuracy and dependability of EYE-HYE.

BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

The TERRY

TERRY
SOLID WHEEL TURBINE
ADVANTAGES . . .

— The blades and the wheel (see above) are in one piece so that there are no parts to become loose or work out.

— The blades have large clearances.

— The blades are double rim protected.

— End play will not damage the blading.

— It is impossible for the blades to foul.

— The power producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets and, therefore, close blade clearance is not necessary.

— As the only function of the blades is to form a series of pockets, wear of the blade edges is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

— The Terry wheel will withstand abuse that would wreck any built up wheel.

THE TERRY STEAM TURBINE CO.

Wheel Turbine

At right—
Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized

T-1147

TERRY SQUARE - HARTFORD, CONN.

W. H. & L. D. Betz
REGISTERED PROFESSIONAL CHEMICAL ENGINEERS
CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS
GENERAL OFFICES AND LABORATORIES
GILLINGHAM AND WORTH STREETS
FRANKFORD, PHILADELPHIA, PA.
SPECIAL SERVICE INFORMATION
In order to present an intelligent study of your individual conditions the following information is required.
PLEASE PRINT INFORMATION
Company Name [redacted] Chemical Company
Address Chicago, Ill.
Type of Business Mfg. of Heavy Chemicals
Party interviewed H. Boyer
Original Report to R. Shepherd
Copy of Report to H. Boyer
Date 1-15-44
Address Same
Title Power Engr.
Title Gen. Mgr.
Title Above
BOILER DATA
1. Boiler Number 1 2 3
2. Manufacturer B.&W. B.&W. B.&W.
3. Type* 4 Drum 4 Drum 4 Drum
4. Rated Capacity (H.P. or Lbs. of Steam per Hr.) 75,000 #/hr 75,000 #/hr 75,000 #/hr
5. Average Developed Capacity 60,000 #/hr 60,000 #/hr 60,000 #/hr
6. Maximum Developed Capacity 75,000 #/hr 75,000 #/hr 75,000 #/hr
7. Minimum Developed Capacity 55,000 " 55,000 " 55,000 "
7a. Number of boilers used at one time 2
(b) Hours at full load 24
(c) Days operated per week 6
8. Average steam pressure, operating 400
p.s.i., Designed for 425
p.s.i.
9a. Are superheaters employed? Yes Type B.&W.
Total Steam Temperature 615 °F.
9b. Are desuperheaters employed? No Type —
Source of desuperheating water —
9c. Purpose for which steam is used, Process —
Heat —
Power —
10. Are economizers in use? No Type —
11. Are water walls in use? Yes Roof No. Floor Blueprint.
12. At what point does feed water enter?* Rear Drum Tro
13. Are feed water regulators employed? No Typ
14. Are boilers equipped with steam purifying devices? A
14a. If no such devices are in use, do boilers have dry pipes?
15. Are boiler drums riveted ☐, Welded ☒, Internally caul
sketch on page 8.

This is the first of a series of advertisements outlining the fundamentals of Betz service.

HOW BETZ BOILER WATER CONDITIONING IS BUILT *Exactly for You*

● It is a well-known fact that no two boiler plant operations can ever be identical, and it is upon this premise that Betz extends its supervisory service for industrial boiler water conditioning.

On the facing page is shown a part of the Information Sheets used by Betz chemical engineers in surveying individual boiler plant operations. Six pages in number, these sheets provide for answers to over 100 questions pertaining to specific boiler data, feed water heating, water and fuel data, internal condition of boilers, present internal and external treatment, etc. The completeness of these plant studies may be illustrated by the following partial list of points investigated on one factor only, namely, the feed water heating:

1. *Type of feed water heater in use*
2. *If deaerating heater, the temperature of water leaving heater and back pressure*
3. *If closed heater, the temperature of water at point last vented to atmosphere*
4. *Residual oxygen content of water leaving heater*
5. *Proportion of live to exhaust steam used in heater*
6. *Amount of exhaust steam available*
7. *Height of heater water level above feed pump*
8. *Plant experience as to steam binding of pumps*
9. *Type of oil separators employed with feed water heater*

This information together with a diagram of the steam/water flow throughout the plant, a diagram of the type boiler, and detailed sketches showing point of feed-water entrance, continuous blow take-off, internal baffling, point of chemical feed, etc. is sent to our laboratories where the information is studied and correlated with the analyses of water samples obtained at the plant. We then prepare a comprehensive report of findings with recommendations for proper chemical treatment and control, which is submitted to the power plant engineer for his further study. This complete plant investigation and report is our first step in rendering a detailed supervisory service.

It is the constant aim of the Betz organization to render a complete, detailed and individual supervisory service for boiler water conditioning—a service to achieve these results: the prevention of boiler scale; prevention of economizer and feed line deposits; elimination of corrosion and pitting throughout the system; prevention of foaming, priming and carryover; prevention of embrittlement; economy of blowdown; general operating efficiency.

W. H. & L. D. BETZ

Gillingham & Worth Sts., Frankford, Philadelphia 24, Penna.

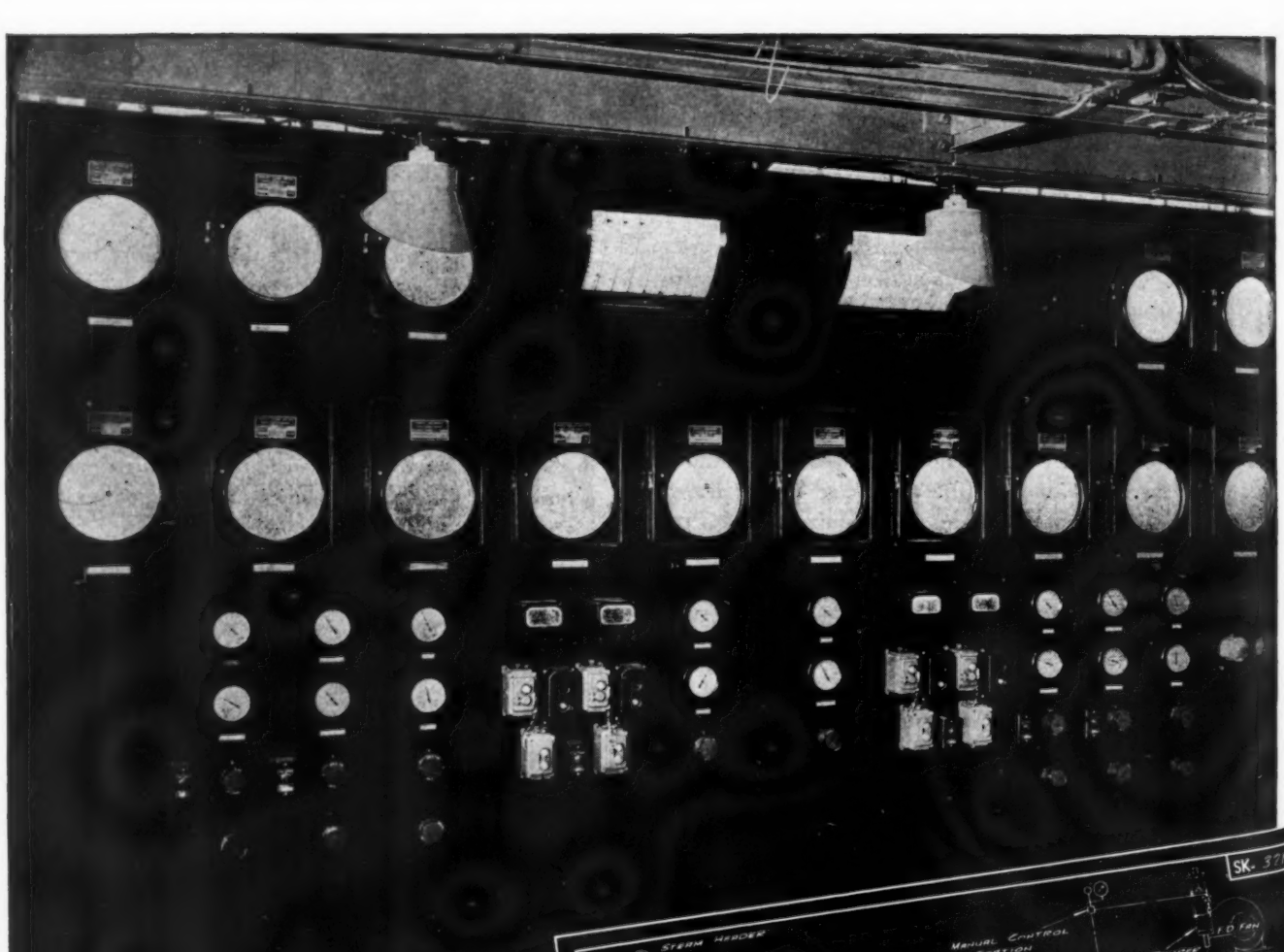
THE 6 FUNDAMENTALS OF BETZ BOILER WATER CONDITIONING SERVICE

1. **Complete plant investigation and report**
2. Establishment of plant control
3. Daily plant control tests
4. Detailed review of plant tests and report
5. Supplementary complete laboratory analyses
6. Periodic "check-up" visits

CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS

BETZ

Write your own



Hagan Combustion Control System in the power plant of an industrial alcohol producer. The control system has been in continuous operation for years and has proved absolutely dependable.

• • •

Here is a diagram for a complete and unexcelled general boiler combustion control system. It isn't anybody's installation in particular though it could be. Note its simplicity, the absence of complicating details. Imagine the freedom from responsibility such a complete coordination of working parts would give you. They are your eyes and your hands—tireless, dependable, always on the job.

Specifications

FOR COMBUSTION CONTROL

. . . and see how closely they are met by Hagan!

SUPPOSE you were to put down on paper your own conception of what an ideal system of Automatic Combustion Control should offer. It would look something like this.

1. It should be simple and foolproof. Hagan Control operates on a simple pneumatic system. The slightest or the most sudden change in steam pressure starts a chain of operations which quickly restores steam pressure to normal. This is all automatic and foolproof. No operator needs to watch instruments or make adjustments.

2. It should be absolutely dependable. Hagan Control is as carefully engineered as any machine. It does not depend on fragile instruments for its operation. Some of the first units of Hagan Control installed 25 years ago are still in daily service.

3. It should be accurate and flexible. Hagan Control is designed to operate accurately and quickly without "hunting." It is flexible in operation so that it can be used for any type of fuel with equally good results.

4. It should be economical with fuel. Fuel savings up to 10% are not unusual with Hagan Control. There are many cases where higher savings have been made. The general use of automatic combustion control in power plants has been a major factor in relieving fuel shortages in this war.

5. It should give uninterrupted service. Hagan Control is designed to stay in continuous operation in hot, dirty locations. It is built ruggedly and requires little maintenance or adjustment.

Find out about Hagan Control. It is used not only for boilers, but is also applied to all types of industrial furnaces, steel mills, and chemical processes.

HAGAN CONTROL ASSURES

MAXIMUM quantity of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

MAXIMUM utilization value of steam, uniform steam pressure and temperature.

MAXIMUM output from boilers of differing capacities, automatically.

MAXIMUM steam for production, by reducing loss of steam in frequent soot blowing.

MAXIMUM protection of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.

HAGAN HALL BUROMIN CALGON

HAGAN CORPORATION · HAGAN BUILDING · PITTSBURGH 30, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

Meet Mr. Quality

ONE LOOK AT Bill Seebode — 50 year man at Allis-Chalmers Norwood Works — tells you that he sleeps well nights.

One reason is that he and hundreds of his fellow craftsmen at Allis-Chalmers have won *and are keeping* the confidence of engineers and operating men throughout American Industry.

That means a lot to veterans like Bill who've made a career of building great motors.

Bill's a stator-winder, as you can see—a living example of the truism that *men* make motors.

No machine known can assemble the maze of wiring and insulation that goes into a stator with his skill and care. No machine can fully test how *well* he's done his job.

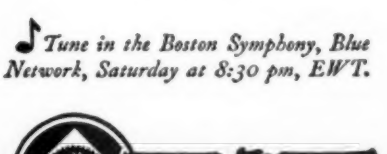
There's only one test . . . wait 5, 10, 15 years and *see*.

And that's the test that has proved Allis-Chalmers motors are *great* motors. That's why you hear it said so often: *"You can depend on Allis-Chalmers Motors!"*

Yes, hundreds of Allis-Chalmers men—*quality* men like Bill Seebode — know they have a big personal stake in every Allis-Chalmers motor. When they build a great motor for you, they're making a friend . . . and they know that's something no company and its workers can have too many of. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

• • •

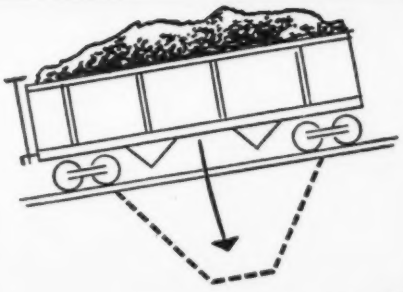
♪ *Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.*

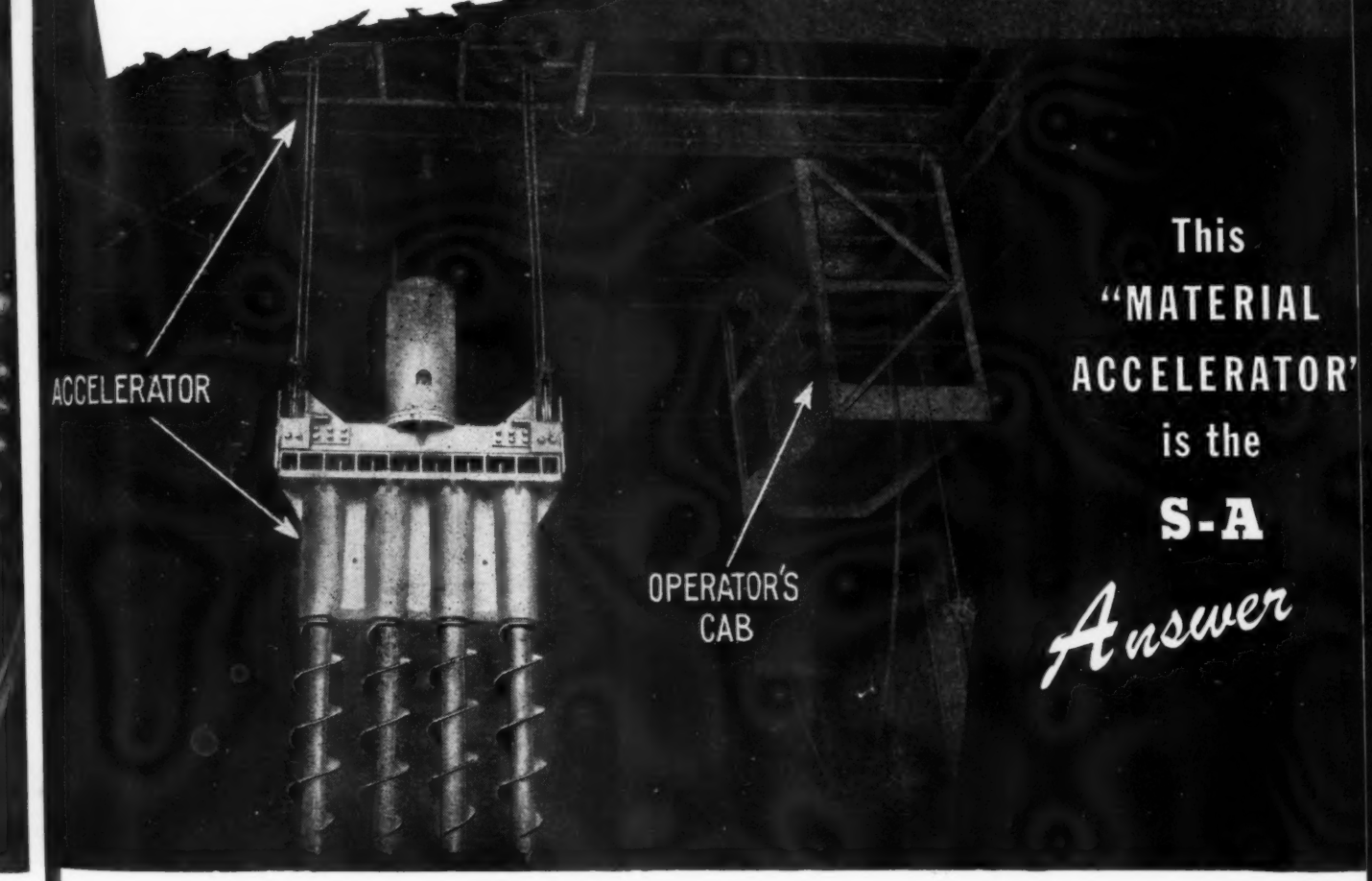


A 1729

YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS

The Problem — To Speed up and reduce cost of unloading frozen or wet, fine coal from hopper cars —





This "MATERIAL ACCELERATOR" is the **S-A** *Answer*

• In addition to systems designed to solve the more general problems of conveying and elevating coal, S-A has equipment developed to meet special or unusual needs.

The S-A Material Accelerator shown here, is a case in point. With this unit, frozen coal or fine wet coal—always a major problem—can be unloaded much more rapidly than with previous methods (2 to 3 times as fast in a typical case on record).

Here's how it works: The screws of the Material Accelerator are lowered into the frozen or wet coal. After penetration to the full depth, screws are reversed, pushing the coal downward. The whole unit is moved back and forth on an overhead crane bridge on which the hoisting mechanism is mounted.

For full details on the Material Accelerator write us today.

STEPHEN S-A ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

More inside information about POWELL

This small size 200-pound "White Star" Bronze Gate Valve looks very much like the same type of valve in other makes. But back of it—back of every Powell Valve—is nearly a century of specializing in the manufacture of Dependable valves for Industry.

The result of this Powell "know how" is a line of valves ruggedly built to give long, uninterrupted service and require minimum maintenance. These are reasons why Powell Valves are the choice of leading industrial plants throughout the nation.

The complete Powell Line includes all types of valves (Globes, Angles, Gates, Checks, Y's, etc.) not only in bronze, iron and steel but also in a wide variety of pure metals and special alloys to meet every requirement for corrosion resistance (Catalogs on request).

And if you have any unusual flow control problems, Powell Engineers will be glad to make a careful study of your requirements and design special valves to meet the conditions.

The Wm. Powell Co.

Dependable Valves Since 1846

Cincinnati 22, Ohio

This valve, especially adapted for steam, oil, water or gas lines is widely used in the Nation's leading refineries.

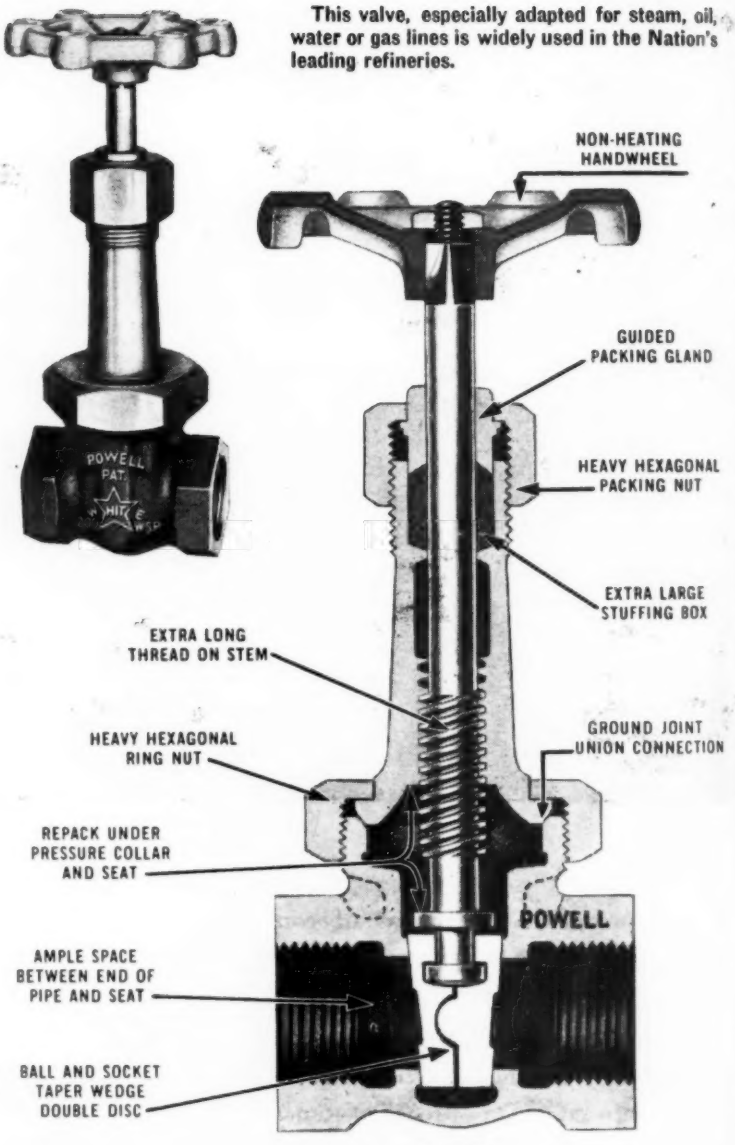
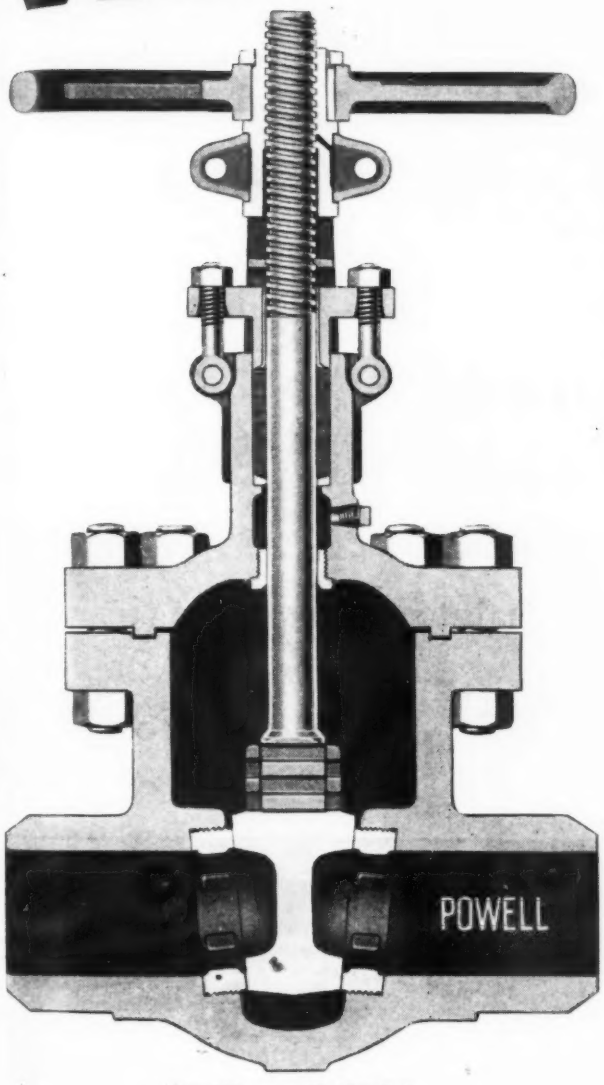

NON-HEATING HANDWHEEL
GUIDED PACKING GLAND
HEAVY HEXAGONAL PACKING NUT
EXTRA LARGE STUFFING BOX
EXTRA LONG THREAD ON STEM
HEAVY HEXAGONAL RING NUT
GROUND JOINT UNION CONNECTION
REPACK UNDER PRESSURE COLLAR AND SEAT
AMPLE SPACE BETWEEN END OF PIPE AND SEAT
BALL AND SOCKET TAPER WEDGE DOUBLE DISC
POWELL
POWELL PAT.
WHITE STAR

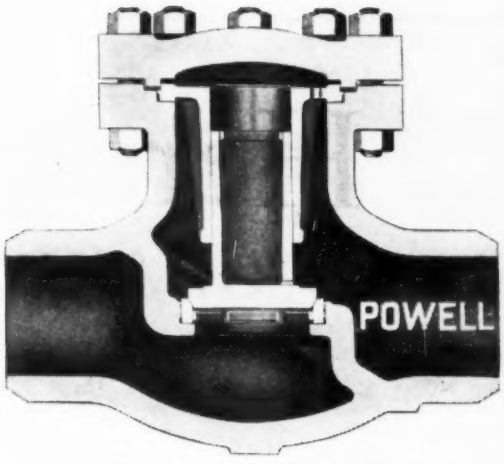
Fig. 375
BRONZE "WHITE STAR" GATE VALVE

POWELL

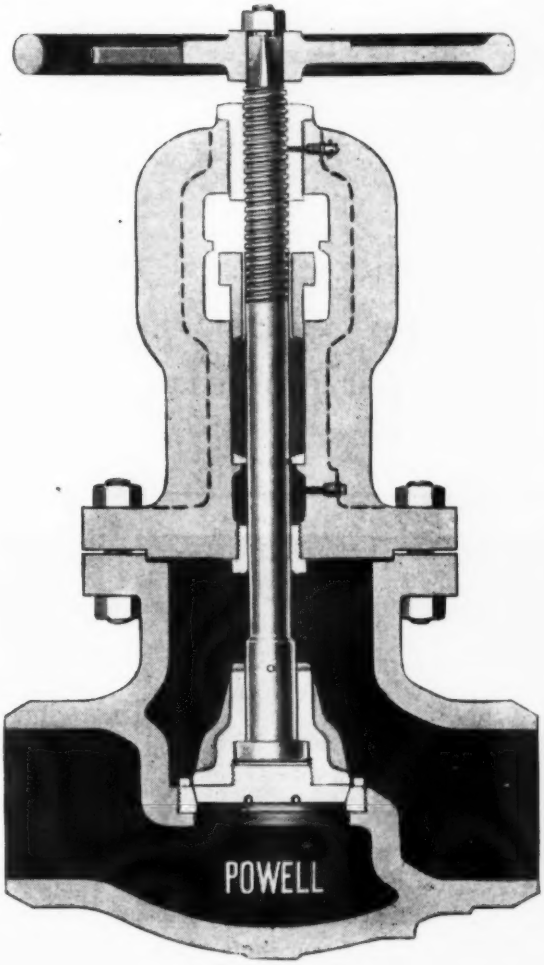
VALVES



Class 900-pound, Welding End,
Cast Steel Gate Valve.



Class 600-pound, Welding End, Cast
Steel Horizontal Lift Check Valve.

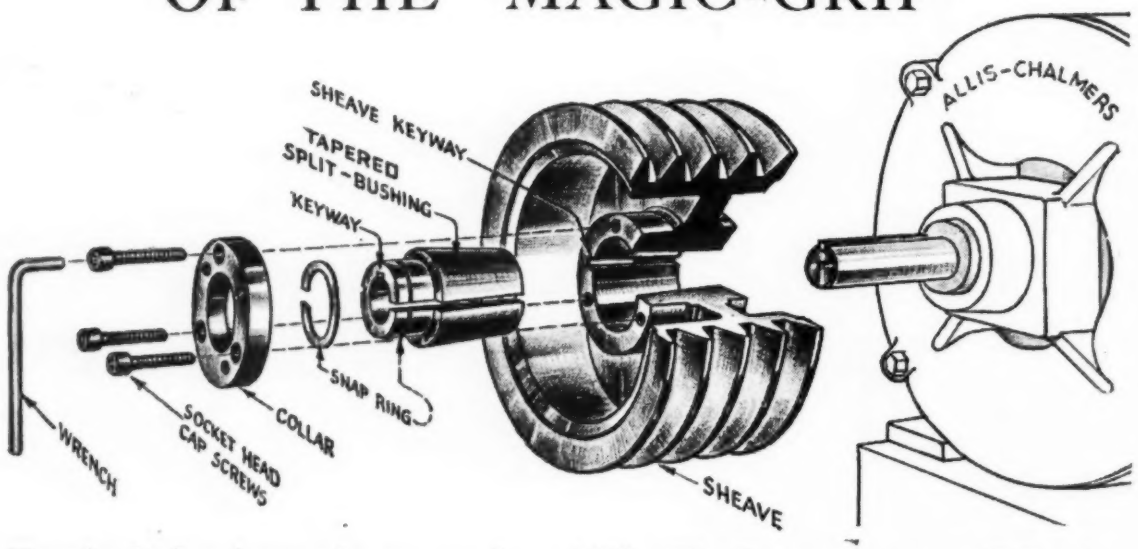


Class 300-pound, Welding End,
Cast Steel Globe Valve.

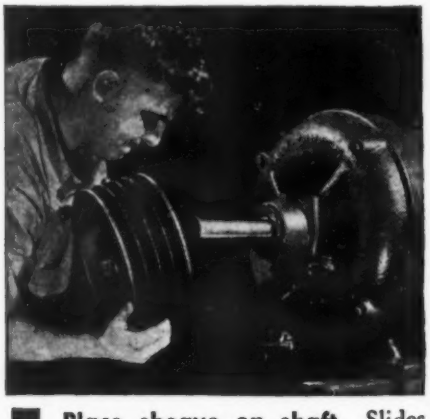
To meet the trend toward higher pressures and temperatures in the power field, Powell has a complete line of Cast Steel Valves—Globe, Angle, Gate, Y, Check, Non-return etc. Hand, Gear and Motor Operated—for working steam pressures from 150 to 2500 pounds and temperatures as high as 1400 F.

VALVES

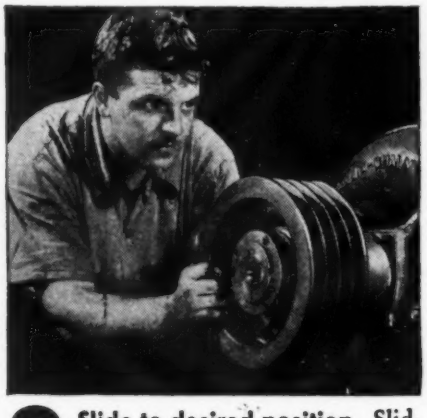
Here's the Secret
OF THE "MAGIC-GRIP"



Exploded view shows why Allis-Chalmers' new "Magic-Grip" Sheave goes on *as a unit in 3 easy steps.* It's the fastest mounting sheave on the market—at no extra cost.



1 Place sheave on shaft. Slides on smoothly because clearance is provided by expanded bushing. There's *no* hammering — *no* forcing! Complete sheave and bushing unit comes intact—ready for quick, easy mounting.



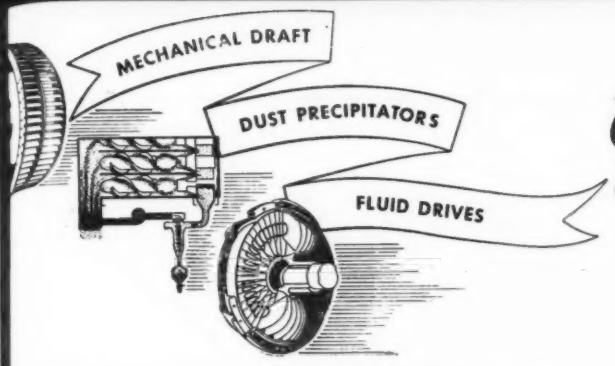
2 Slide to desired position. Sliding easily, sheave can be placed *exactly* according to straight-edge ... giving you true alignment with resulting smooth performance. A minimum of time is required.

3 Tighten three capscrews — and it's ready to go! Entire sheave is locked securely to shaft and *grips like magic!* No set screws to damage shaft. Send for Bulletin B6310. Allis-Chalmers, Milwaukee 1, Wis.

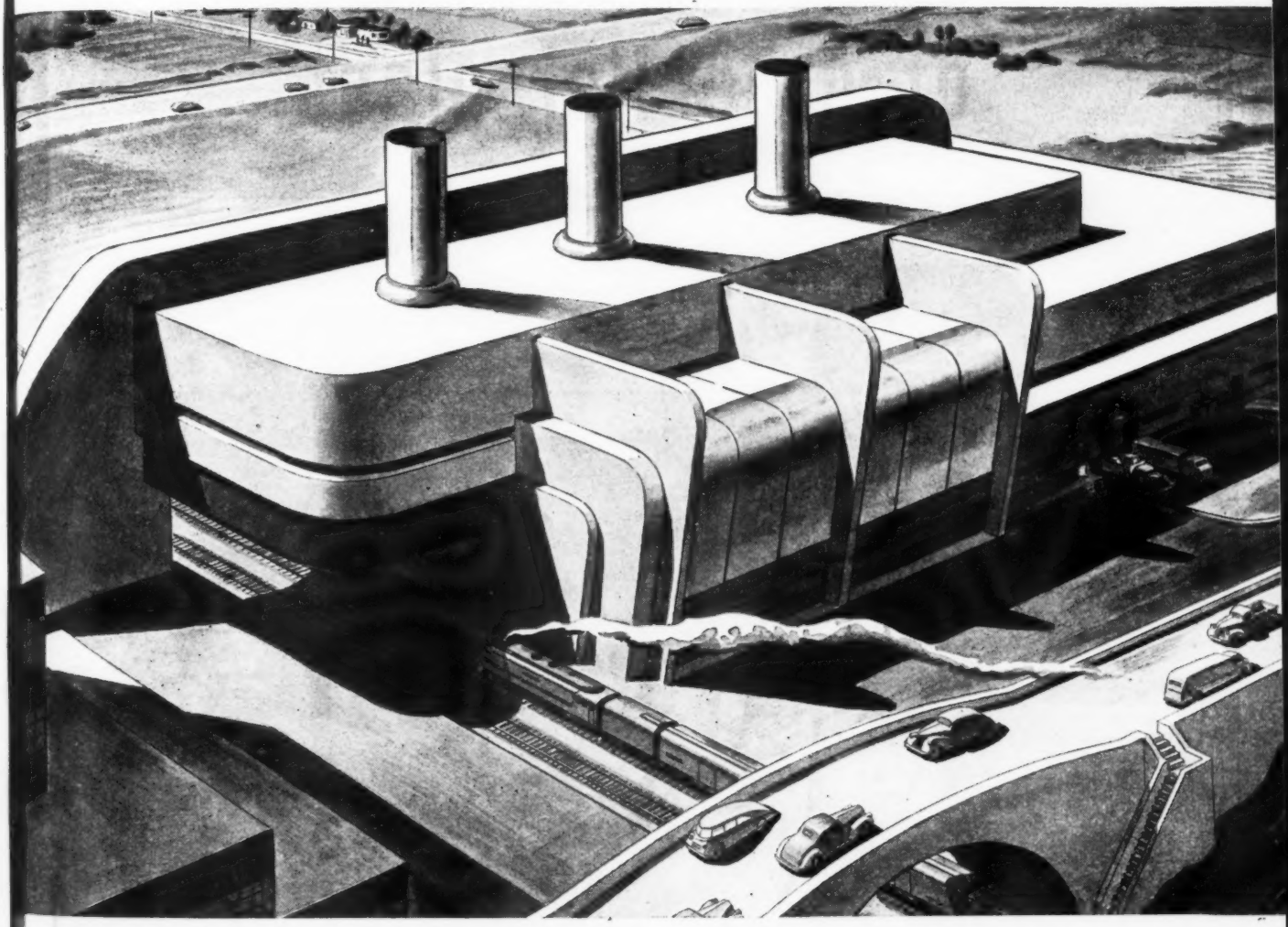
A 1764

Allis-Chalmers Texrope

"MAGIC-GRIP" SHEAVES



You can buy all 3 from A.B.C.



WHETHER YOU BUILD A NEW PLANT or modernize your present one, you appreciate the value of undivided responsibility in your purchase of equipment . . . American Blower Mechanical Draft Fans are widely used in many of the leading power plants. American Blower Fluid Drives improve overall power plant efficiency and provide stepless variable speed fan control for this equipment. American Blower ST Dust Precipitators do away with the fly ash nuisance and definitely reduce fan maintenance . . . Yes, and you can buy all 3 from the same representative of ABC.

W TO SOLVE YOUR FLY ASH PROBLEMS. The photograph, on right, ws a part of our modern Dust Testing Laboratory. In the last 20 years, have run tests on more than 4100 distinctly different materials. Here, plete equipment is available for microscopic investigations, screen lyses and collector performance. American Blower is the world's st and largest manufacturer of dry type dust precipitators. We have largest facilities in the industry, and every precipitator we sell is t entirely in our own plants.

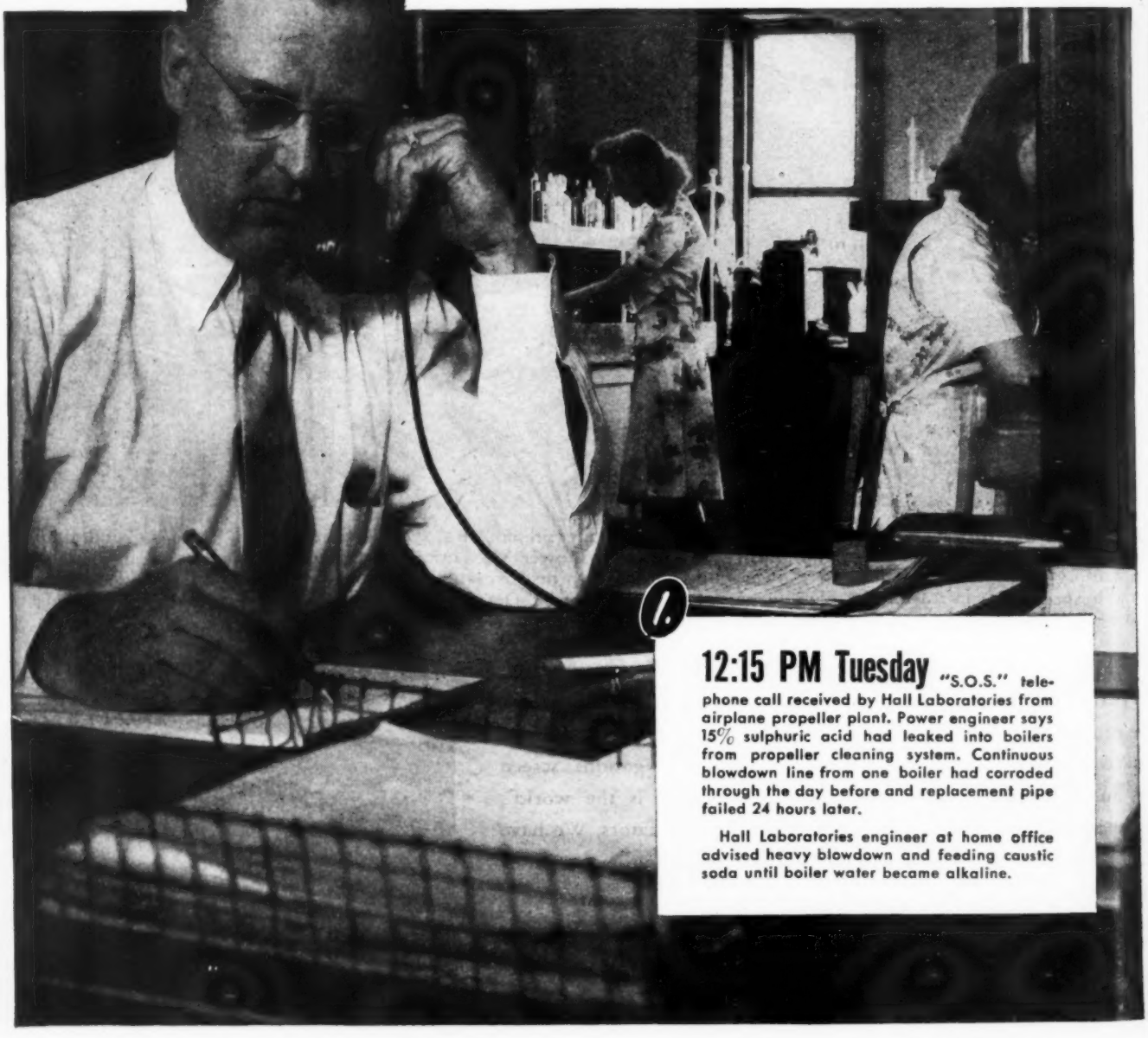
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

Sulphuric acid in boilers threatens shutdown of propeller plant

Quick action by Hall Service Engineers saves vital war production boilers



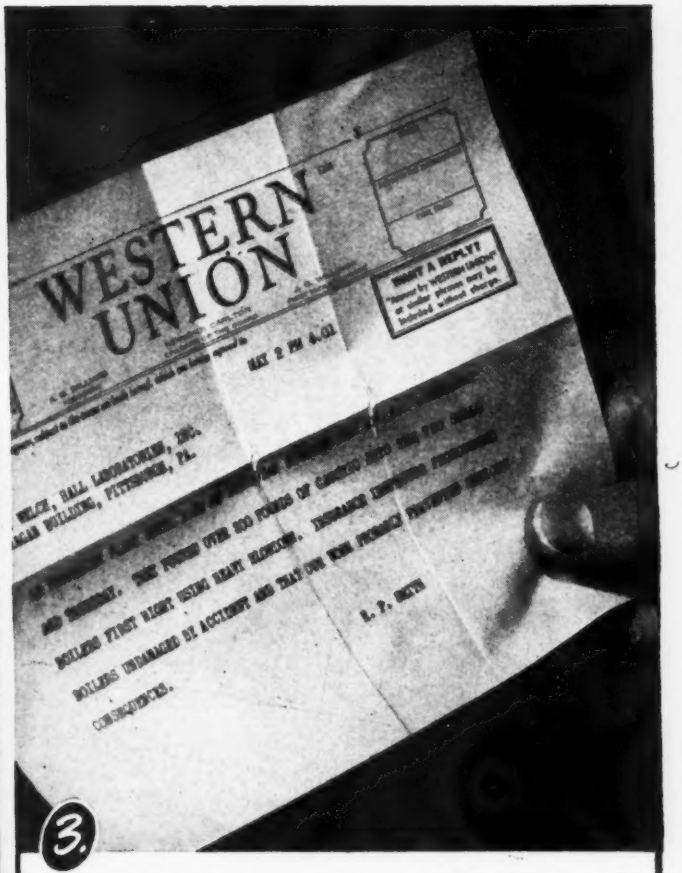
1.

12:15 PM Tuesday "S.O.S." telephone call received by Hall Laboratories from airplane propeller plant. Power engineer says 15% sulphuric acid had leaked into boilers from propeller cleaning system. Continuous blowdown line from one boiler had corroded through the day before and replacement pipe failed 24 hours later.

Hall Laboratories engineer at home office advised heavy blowdown and feeding caustic soda until boiler water became alkaline.

2.

1:30 PM Hall Field Service Engineer was located and instructed to get to propeller plant as soon as possible as boiler condition appeared serious enough to warrant shutting down boilers.



3.

4:00 PM Friday Telegram from Hall Service Engineer to home office: "At propeller plant until 1:00 AM Wednesday morning and all day Wednesday and Thursday. They poured over 200 pounds of caustic into the two small boilers first night using heavy blowdown. Insurance inspector pronounced boilers undamaged by accident and that our work probably prevented serious consequences."

THIS case history shows that, in addition to their regular work of trouble prevention, Hall Service Engineers are available and able to cope with the unexpected emergency. This is a decided advantage when added to the benefits of *Preventive Care*.

Hall *Preventive Care* is the natural and obvious remedy for unscheduled outages—the practice of scientific supervision to prevent boiler troubles due to all kinds of scale from calcium carbonate to silica, and to corrosion, embrittlement and carryover. There is no substitute for this constant scientific supervision. When the unexpected does occur, however, the Hall Service man can give you the benefit of his own experience plus that of the men who are responsible for many of the most important developments in boiler water conditioning.

HALL LABORATORIES · HAGAN BUILDING · PITTSBURGH 30, PA.

HAGAN HALL BUROMIN CALGON

HALL SYSTEM of Boiler Water Conditioning

Hall Service in a Nutshell

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full cooperation, Hall Service:

1. Minimizes boiler outages caused by water.
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water.
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.

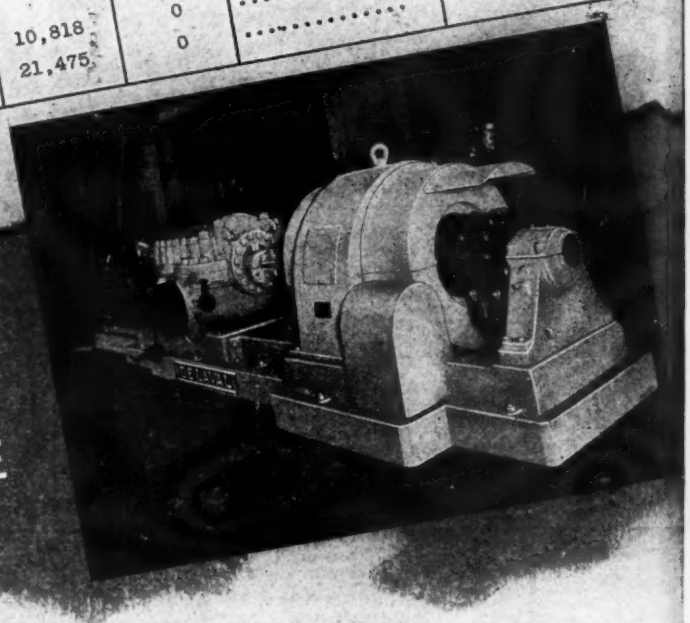
Look at the Record!

SERVICE RECORD—As of September 1, 1944

DE LAVAL PUMPS at _____

No.	Discharge Pressure psig	Suction Temp. °F.	Placed in Service	Total Service Hours	Outages Due to Pump	Cause of Outages	Approx. % Increase in Pump Power
14	1186	260°	12- 2-38	40,383	2	Replace ball locating bearing and shaft sleeves	Negligible
					1	Replace shaft sleeves	Negligible
15	1186	260°	10-11-40	28,839	0	.....	Negligible
21	1186	350°	8- 4-39	10,818	0	.....	5%
16	1186	260°	1- 2-42	21,475			

Capacity (all units).....1455 g.p.m.



of DE LAVAL HIGH-PRESSURE BOILER-FEED PUMP PERFORMANCE

Not one major trouble after as much as 40,000 hours of service!

The first of these units was installed in February, 1938; the most recent in February, 1942. All have demonstrated the satisfactory performance of De Laval boiler-feed pumps for high-pressure central station service.

Other important installations, operating at pressures up to 1600 psi and handling high temperature feed water, are operating with equal freedom from trouble, due in no small measure to the excellent performance of the De Laval automatic balancing device, the De Laval large clearance labyrinth wearing rings, and the sturdiness of De Laval solid end head construction.

3629

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

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POWER

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A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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(Cover picture: official U. S. Navy photo)

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Life saver? Sure! And that's exactly what spray protection means to the rotor shaft of every Westinghouse Type C Turbine. A generous coating of corrosion-resisting steel is sprayed on at the gland zones to prevent shaft rusting after long shutdowns . . . providing insurance against excessive gland leakage and oil contamination.

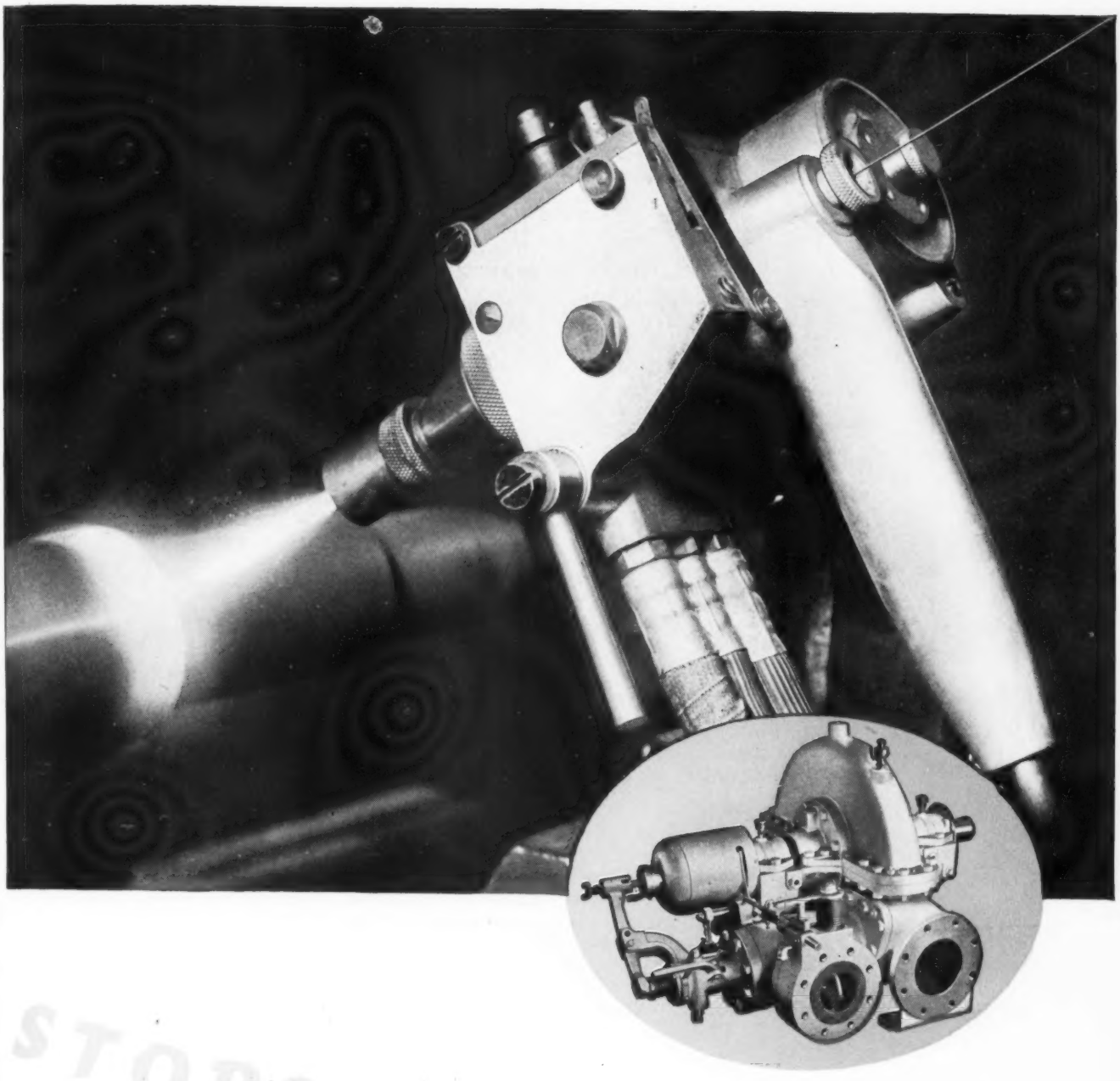
Shaft protection is just *one* of the many plus values that make these Westinghouse general-purpose mechanical drives the "most turbine for your money". When you buy a Type C, you get extra reliability, extra safety, extra economy in operation—and the use of steam drives may improve the heat balance of your entire plant.

Westinghouse Type C Turbines are built in five different sizes, covering a range of 5 to 1500 hp. The long list of proved-in-service installations includes pumps, forced and induced draft fans, pulverizers, compressors, Jordans, pulp beaters, line shafts, generators—and many other applications where steam drives are used to improve over-all heat balance. For complete information call your nearest Westinghouse representative. Westinghouse Electric & Manufacturing Co., Box 868, Pittsburgh 30, Penna.

J-50459

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



STOPS SHAFT RUST

ON WESTINGHOUSE TYPE C TURBINES

High chrome-nickel steel is sprayed on at the two gland zones of every Westinghouse Type C Turbine shaft. To prove a permanent anchor for the sprayed metal, the shaft is grooved, undercut and knurled. Then the metal, fed from a wire roll, is applied with an oxyacetylene torch. After spraying, the entire shaft is finish-ground.

This Westinghouse shaft-spraying process is an important hidden value of the Type C Turbine. Rust protection prevents excessive steam leakage and oil contamination resulting from rust-cut carbon gland segments.

Steam Headquarters

WESTINGHOUSE

BYERS WROUGHT IRON

THIS SERVICE CALLS FOR DEPENDABILITY ALL ALONG THE LINE

The pressure-gauge wasn't located so it could be included in the picture . . . but when this water-line was photographed, the pointer was vibrating at the 750-lb. mark. Where such pressures are concerned, careful designers add not only the usual safety factor, but a *corrosion* factor as well. For it is not the original strength and section of the pipe, but the strength and section after extended service that determine the life, economy, safety and satisfaction of the installation. With that thought in mind, the engineers used Byers Wrought Iron.

The reason why engineers feel safe in using a more favorable "corrosion factor" with wrought iron is plain to see when the *way* in which it combats corrosion is understood. The main body of the material is high-purity iron. Through it are threaded countless tiny fibers of glass-like silicate slag. When corrosion encounters any fibers, it is halted—*and diffused.* Instead of the pitting and speedy penetration that is common with ordinary materials, corrosive action is distributed uniformly over the surface. The useful life of the material is thus determined by the time in which the entire section is reduced, rather than the time required for local attack to bore through the wall.

Even when water is not unusually aggressive initially, the use of wrought iron generally adds a comfortable safeguard. The corrosive characteristics of water from a single source can shift from mild to severe in a short time, and with no warning. And when a supplementary supply becomes necessary, all of the factors that influenced the original pipe selection can alter completely. No single material can provide insurance against all the changes that might occur, but the evidence of hundreds of successful installations indicates that wrought iron can usually withstand such changes better.

The dependability of wrought iron is a highly important advantage in high-pressure water lines, but it is a highly profitable maintenance-cutter in any water lines. Our bulletin, "Wrought Iron for Piping Systems," has interesting and helpful information on the general problems encountered in almost every plant, and you are welcome to a copy, on request. If, after reading it, you would like specific data on any individual service, just ask our Engineering Service Department.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • FEBRUARY 1945 • ESTABLISHED IN 1882

Basic Studies for Power Leaders

THERE'S NEVER any end of study for power engineers. No man is smart enough, or lives long enough, to attain full competence in this field. Yet experience proves that the shrewdly studious engineer can lift himself far above the crowd in capacity, recognition and salary.

What basic knowledge will help him most? Here are some suggestions based on long observation of power-plant careers:

LANGUAGE OF WORDS—To get essential cooperation from subordinates, associates and executives the power engineer should speak and write skillfully. Keep a dictionary handy. Study practical books on writing. Join public speaking classes. Practice report writing, and study good models.

LANGUAGE OF MATHEMATICS — Become letter perfect in everyday arithmetic. Gain skill with the slide rule. Review elementary algebra, geometry, trigonometry.

LANGUAGE OF PICTURES—If you have mastered the making and reading of orthographic plans, elevations and sections, study isometric sketching (page 87) to profit much from little effort. Pictures sell ideas.

PHYSICS AND CHEMISTRY—These are the scientific cornerstone of all engineering. Study regular first-year college textbooks from cover to cover, working all problems.

ENGINEERING ECONOMICS—In your engineering handbook you'll find a chapter showing how to evaluate engineering investments and savings. Important information, and not hard to acquire!

ACCOUNTING—No need to be a CPA, but every engineer should understand the ABC's of accounting. There are many good, practical books.

PERSONNEL MANAGEMENT—This too is a science, as well as an art. You will handle people better after taking a course or reading books on the subject.

FORMS AND RECORDS—Here books won't help so much, but you might collect and study power-plant examples. Plant records should make full use of instruments.

INFORMATION SOURCES — Organize your catalog files. Learn how to locate needed articles and books. Keep pace with new equipment. Search your neighbor's plant for new ideas.

FINALLY, here are three comments to keep the record straight:

First, the listed studies are fundamental in character—useful for war as well as peace. That's why the Army is teaching every one of them to tens of thousands of soldiers of all ranks.

Second, many additional special accomplishments, not here listed, are needed for specific jobs.

Third, it is not implied that a man lacking some of the listed fundamentals cannot be a successful engineer. Superlative common sense and mechanical "know how" have won real recognition for many a power engineer who has had little opportunity for schooling in math, science and English.

Kobuta Plant Licks Problems of 65% MAKEUP and 10-40% BLOWDOWN

A reinforced-concrete building that saved tons of critical structural steel houses the power plant. An 80-ft concrete arch forms the generator-room roof

Large synthetic rubber plant developed under war restrictions operates four 350,000-lb-per-hr boilers and will soon get a fifth to carry the increased load from process changes

▶ BECAUSE THE NEED for synthetic rubber was imperative, engineering skill devised new methods for rapid construction of a plant at Kobuta, Pa. Result was the reinforced-concrete structure, shown in the photo, which houses an 8-story boiler room and a generator room with an 80-ft concrete arch forming its roof. Savings were effected by the most efficient use of critical materials. For instance, the amount of copper for heavy conductors and conduit was reduced by placing near the boiler-room basement the auxiliary power switchgear of the main electrical bus located in the generator room.

More than one million pounds of steam per hour, coming from the huge boiler room, flow through the turbine to produce 35,000 kw before going on to operate stills and compressors throughout the plant.

Original plans called for four 350,000-lb-per-hr boilers at 700 psi and 750 F. One single-drum forced-circulation unit and three 2-drum natural-circulation units were installed. Operating experience indicated that capacity of the four original boilers was not sufficient to supply all the steam demanded by production units. Accordingly, a fifth boiler of 180,000-lb-per-hr capacity at 450 psi without superheat is now being installed.

Draft Fan Drive

An important factor in selecting boiler capacity was limitation of mechanical draft equipment to single fans per boiler so as to require a minimum number of reduction-geared turbine drives—an extremely critical item during the construction period. Including flyash collection equipment within the induced-fan housings offered minimum use of steel.

Coal comes to the plant by rail and barge. Belt conveyors transport it from unloading points to storage (100,000-ton capacity) or directly into the crusher house where it is sized to ¾ in. before entering the bunker house. An automatic feeder tripper distributes coal into eight 250-ton hoppers, from which it drops by gravity through automatic scales to the pulverizers at each boiler.

Residue gas and oil from the rubber process is piped directly to the boiler room. Amount of gas burned depends on excess available after the plant has met process needs, which require 15-psi pressure. Gas fed to the furnaces is hand regulated to maintain a pressure range between 2 and 7 psi on the boiler-room supply. Oil is pumped from storage tanks and fired according to the amount available.

Combustion control regulates air and coal feed according to steam demands. Hand preadjustment of the control mechanism assures sufficient combustion air for oil and gas. Boilers are usually

lighted off with oil or gas and brought up to pressure before coal feed begins. Liberal furnace volume permits carrying full load on coal alone, consuming 1200 to 1400 tons per 24 hr. No slagging trouble is encountered because coal has an ash-fusing temperature above 2100 F; slight slagging may occur with fusion temperatures lower than this value. Two 20,000-lb-per-hr pulverizers supply each of the four boilers.

Combination of two coal-and-gas and two coal-and-oil burners fire the forced-circulation boiler. Natural-circulation boiler furnaces are fitted with six combination-coal-and-oil and two separate gas burners.

Ash Removal

Furnaces are dry bottom with intermittent ash-sluicing facilities. Flyash removed from furnace passes and skimmed from the induced-draft fan case enters a hopper and continuous sluicing system that transports it together with furnace-bottom ash to a disposal pit some distance away. Vapor from sluicing water has not yet caused any corrosion of boiler tubes. Induced-draft fans, now turbine driven, are being fitted with dual drive by connecting motors on the fan shaft extensions. Motors are capable of furnishing draft for one-third steam capacity.

To prevent boiler contamination only a small amount of condensate returns to the feedwater. Raw makeup usually amounts to 65%. Makeup water, coming from a 120,000-gpm pumping station on the Ohio River, varies widely in its solids concentration; in dry season this content runs as high as 550 ppm. Water is first treated in the main filter plant with cold lime-soda plus ferric sulphate coagulant. It then passes through a sludge-blanket precipitator and six concrete gravity filters. Second stage of softening takes place in six automatically operated carbonaceous zeolite units. Further treatment occurs in the boiler room where sodium sulphite, caustic soda and phosphate are added as needed.

Under one extreme condition solids concentration was raised from 514 to 590 ppm in adding sufficient treatment to reduce hardness to an acceptable value. Boiler concentration is maintained below 2000 ppm by continuous blowdown from the steam separators in boiler drum.

Ordinarily a 10.8% continuous blowdown holds solids concentration within the acceptable range, but on one occasion equipment could not maintain the 2000 ppm limit. This occurred in an extremely dry season when the river water contained 550 ppm of solids, which necessitated operating with 30 to 40% blowdown. It was necessary to discharge additional blowdown from mud drums by keeping them open 45 min out of every hour until the boilers could be removed from service and the continuous blowdown equipment made large enough to handle the load.

Steam at 700 psi and 750 F goes to the 35,000-kw turbine-generator which exhausts at 165 psi backpressure for process requirements. Total plant electrical load approximates 14,000 kw; excess goes into the local utility system over a 13,800/66,000-v tieline. It was thought advisable to install excess generating capacity to act as a backlog against any local power shortage that might develop from war industry demands. Although these demands did not occur, arrangements were made on a give-and-take basis to feed excess power from this unit into the utility system.

Process demands steam at a constant pressure of 165 psi. To produce this, the turbine operates on backpressure control rather than system frequency or electrical requirements. A check reading shows the turbine passing 28.8 lb of steam per kwhr at 35,000-kw load.

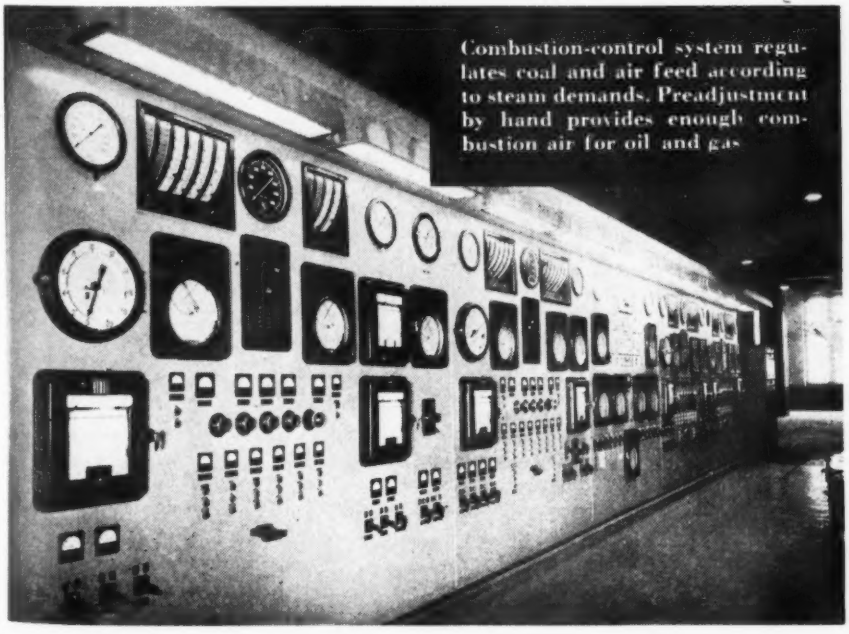
Exhaust steam leaves the turbine discharge and passes into two 24-in. pipes at 165 psi, 1250.5 Btu and 463 F, which maintains a slight superheat to the farthest end of distribution lines. Part of this steam is then reduced to 75 psi for process as needed.

Emergency Steam

To provide against forced turbine shutdown or tieline outage, desuperheaters and pressure-reducing stations form a tie between boiler steam headers and exhaust lines. Any sudden interruption to exhaust-steam supply operates these stations through master controllers set to trip in at 163.5 psi. After they are in operation the regulated pressure is raised to 165 psi by slight hand adjustment of the master control. Desuperheater water comes from the feedwater system through special pumps. It has not been necessary to desuperheat the 75-psi steam (reduced from 165 psi) because superheat disappears quickly after short contact with process heat exchangers. Consequently the steam's moisture content soon wets the vessel surfaces and promotes complete heat transfer.

Feedwater-pump and draft-fan turbine exhaust goes to two deaerating feedwater heaters that handle both return condensate and raw makeup. A reducing valve from main turbine exhaust supplies any deficiency. The high-pressure closed heaters receive steam direct from the main turbine exhaust, supplemented by flash from the blowdown system. Blowdown water then heats incoming boiler-feed makeup.

Generated power goes to either or both of two 13,800-v buses which distribute it over underground feeders throughout the development. Also tying in to these buses is the 13,800/66,000-v tieline from the Duquesne Light & Power system. A working power exchange agreement with this utility permits loading the local generator to meet process exhaust-steam demands. Back feed from the utility through a bank of three 10,000-kva transformers per-



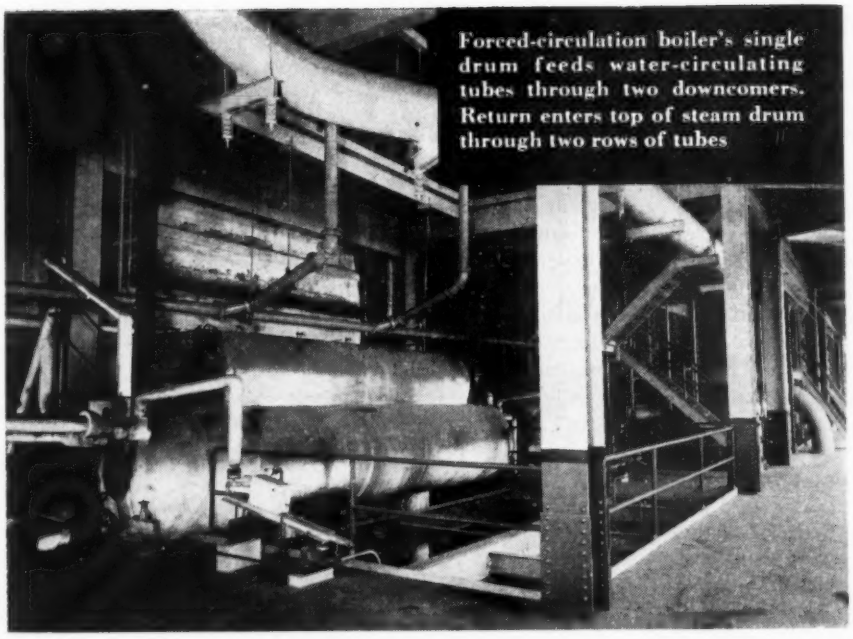
Combustion-control system regulates coal and air feed according to steam demands. Preadjustment by hand provides enough combustion air for oil and gas

mits turbine outage for inspection; process steam then comes from desuperheater stations.

Boilerhouse auxiliary motors receive power at 2300 v, and river pumping station at 4100 v. Same rating transformers (13,800/2300 v) are used in both locations except that pumping-station units are Y-connected on the low side for 4100 v. All other transformers are connected delta-delta.

Since the utility tieline transformers are also delta-delta connected some provision was needed to protect against 13,800 ground faults. This is done by connecting a zigzag transformer (with a grounded neutral) to the main transformer 13,800-v leads. Disconnectors on the zigzag transformer are hand operated and are normally closed. Main generator (Y-connected) has its neutral grounded through a remote-controlled oil circuit breaker. Both the transformer and generator neutrals ground through a resistor.

The 13,800-v distribution feeders run underground and are protected by both overload and ground relays. Ground relay operates on unbalanced current that flows in the overload relay circuit on single-phase faults.



Forced-circulation boiler's single drum feeds water-circulating tubes through two downcomers. Return enters top of steam drum through two rows of tubes

The Kobuta plant was built by the Koppers Co for the Defense Plant Corp and is operated by the Koppers United Co, butadiene div, under contract with the Rubber Reserve Co. Subcontractor Gibbs & Hill of New York did the engineering and construction work on the boilerhouse and powerhouse.

PRINCIPAL STEAM AND ELECTRICAL EQUIPMENT

Kobuta Power Plant

STEAM-GENERATING EQUIPMENT:

Boiler, 1 ..... Combustion Engineering Co, Inc
1 forced circulation, 14,520 sq ft heating surface, 7915 sq ft waterwalls, heat release 18,200 Btu per cu ft, 350,000 lb per hr
Boilers, 3 ..... Babcock & Wilcox Co
Natural circulation, 20,640 sq ft heating surface, 5103 sq ft waterwalls, 29,900 cu ft furnace volume, 350,000 lb per hp
Economizers, 9850 sq ft each ..... Combustion Engineering Co
Soot blowers ..... Diamond Power Specialty Corp
Boiler settings ..... {Combustion Engineering Co, Inc / Babcock & Wilcox Co
Ash disposal ..... Allen-Sherman-Hoff Co
Breeching, ducts and stacks ..... Connery Construction Co
Ljungstrom air preheaters ..... The Air Preheater Corp
38,900 sq ft, 550 F
Combustion control ..... General Regulator Corp
Forced-draft fans, 4 ..... B F Sturtevant Co
111,000 cfm, 10.7 in. water at 100 F, 1200 rpm
Turbine drive, 263 hp, 4500 rpm ..... General Electric Co
Reduction gear, 4500/1200 rpm ..... General Electric Co
Induced-draft fans, 4 ..... B F Sturtevant Co
193,000 cfm, 16.5 in. water inlet pressure at 400 F, 1023 rpm
Turbine drive, 887 hp, 4500 rpm ..... General Electric Co
Reduction gears, 4500/1023 rpm ..... General Electric Co

COAL-HANDLING EQUIPMENT:

Conveyor system ..... Link-Belt Co
400 fpm, 450 tons per hr
Coal crusher ..... Pennsylvania Crusher Co
Coal scales ..... Stock Engineering Co
Track hopper vibrator ..... Jeffrey Mfg Co
Weightometers ..... Merrick Scale Mfg Co
Coal pulverizers
Hardinge units, 6 ..... Foster Wheeler Corp
Raymond units, 2 ..... Combustion Engineering Co, Inc
20,000 lb per hr each

GENERATING EQUIPMENT:

Turbine ..... Westinghouse Electric & Mfg Co
35,000 kw, 3600 rpm, 700 psi and 750 F steam, 165 psi backpressure, 28.8 lb per kwhr at full load, exhaust 1250.6 Btu at 463 F
Generator ..... Westinghouse Electric & Mfg Co
35,000 kw, 13,800 v, 80% pf, 3 phase, 60 cycle, 3600 rpm, hydrogen cooled
Oil purifier ..... Bowser, Inc
Oil cooler ..... Westinghouse Electric & Mfg Co
Oil circuit breakers ..... Westinghouse Electric & Mfg Co

PIPING, VALVES AND FITTINGS:

Feedwater line valves ..... Edward Valve & Mfg Co
Desuperheater and reducing valves ..... Republic Flow Meters Co
Desuperheater pumps ..... {Allis-Chalmers Mfg Co / Goulds Pumps, Inc
Main steam stop valves ..... Chapman Valve Mfg Co
Boiler and steam pipe insulation ..... Philip Carey Mfg Co
Main piping ..... Pittsburgh Piping & Equipment Co
Steam traps ..... Sarco Co, Inc, and Yarnall-Waring Co
Safety valves ..... Consolidated Ashcroft & Hancock Div
Blowdown valves ..... Yarnall-Waring Co
Non-return stop valves ..... Edward Valve & Mfg Co

FEEDWATER SYSTEM:

Water columns and gage glasses ..... Diamond Power Specialty Corp
Water level recorders ..... Bailey Meter Co
Boiler feed pumps ..... Ingersoll-Rand Co
928 gpm, 2240 ft head, 3600 rpm
(1) dual drive (motor and turbine), (1) motor driven and (3) turbine driven—all constant speed and pressure
Turbine drive, 680 hp ..... Westinghouse Electric & Mfg Co
Motor drive, 700 hp ..... General Electric Co
Feedwater regulators ..... Northern Equipment Co
2 element, 350,000 lb per hr
Feedwater heaters, 4 ..... Alco Products Div
165 psi steam, 240 to 364 F, 444,000 lb per hr each
Deaerating heaters, 2 ..... Cochrane Corp
900,000 lb per hr, 75 to 240 F each
Heater drain control, 4 ..... Stets Co
Heater drain coolers, 4 ..... Alco Products Div
Feedwater treatment ..... Permutit Co
Feedwater consultants ..... Hall Laboratories
Chemical feeders ..... Proportioneers, Inc

METERS AND RECORDERS:

Steam-flow meters ..... Bailey Meter Co
Temperature recorders ..... Leeds & Northrup Co
Pressure recorders ..... {Bailey Meter Co / Foxboro Co
Feedwater flowmeters ..... Bailey Meter Co
Draft gages ..... Republic Flow Meters Co
Air compressors for control ..... Ingersoll-Rand Co

Shop Tests Okay Cargo-Ship Turbines

Flash boiler, water rheostats and synchronizing lamps feature test stand for propulsion machinery and auxiliary sets. F W Peterson, development engineer for Joshua Hendy Iron Works, describes some innovations in procedure

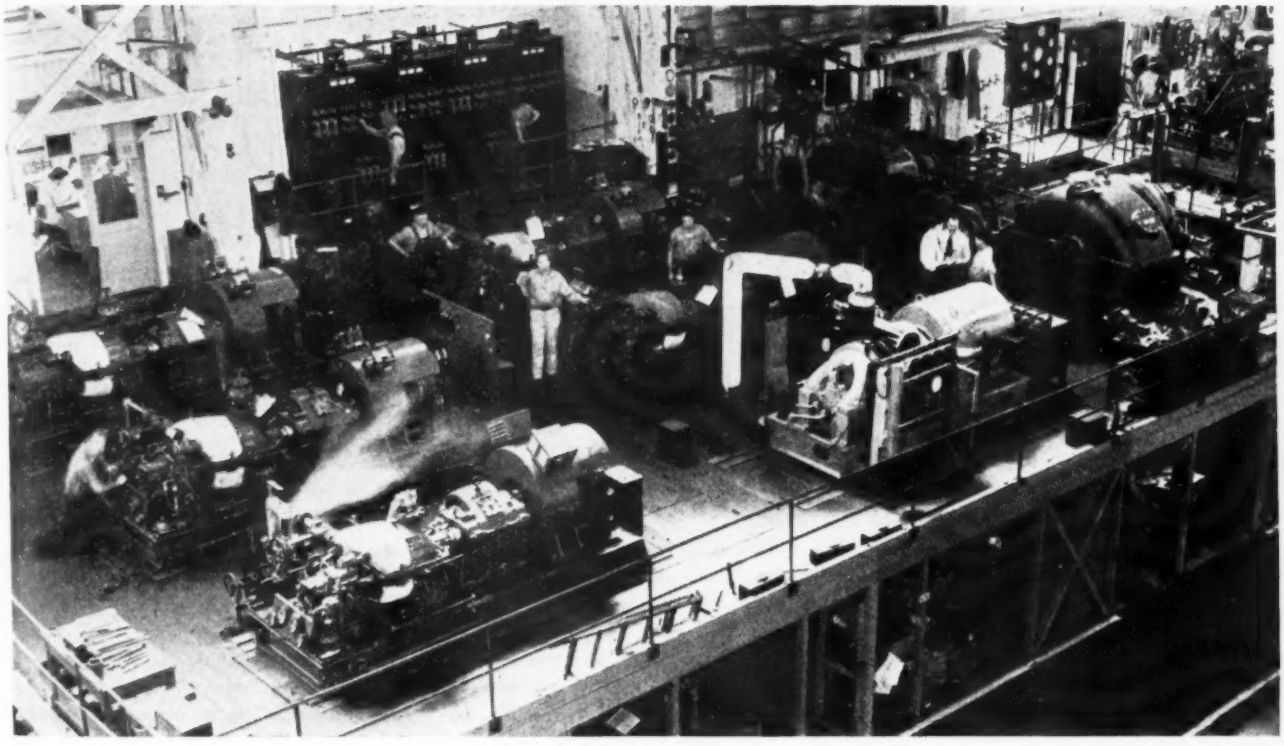


Fig. 1—Test stand with a number of dc auxiliary sets in place. Control board handles four sets at once. Note main-propulsion units being prepared for test in background while several auxiliary turbine-generator sets undergo simultaneous load runs

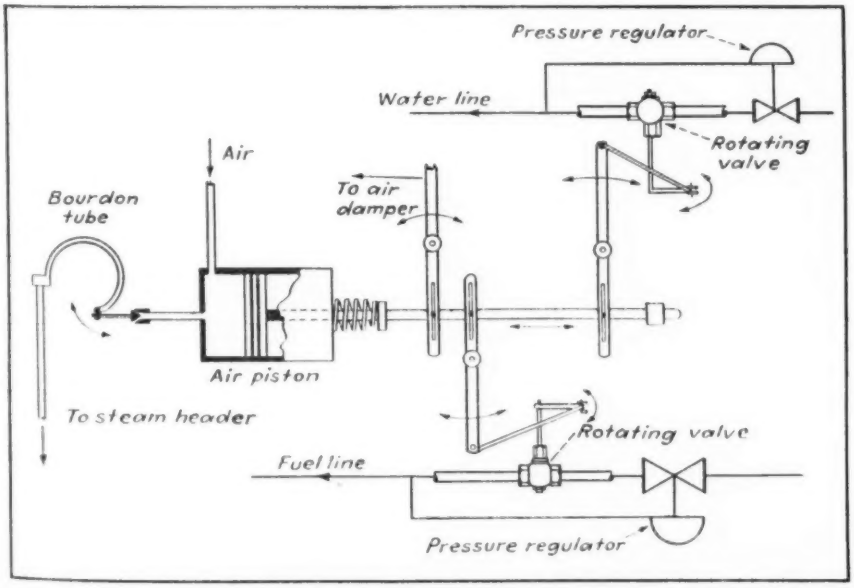


Fig. 2—Compressed-air piston regulates air, water and fuel flows to flash boilers. Bourdon tube, which is actuated by steam-header pressure, moves bleed valve

▶ MAIN-PROPULSION UNITS for C-1, C-3 and C-4 (Victory) cargo vessels and turbine-driven generating sets for auxiliary power require certain tests of interest to operators of land units as well as marine engineers. Also, test equipment to supply steam, dissipate electrical output and control operating conditions, has been developed that may later be adapted to other uses.

Main units designed for 440-psi 740-F steam conditions have high-pressure and low-pressure sections cross compounded to drive the propeller through pinions of a double-reduction gear.

Turbine, reduction gear and generator of auxiliary generating sets are assembled on a common bedplate for easy installation aboardship. Steam conditions vary from 225 psi saturated to 440 psi, 740 F and exhaust ranges from 26- to 28½-in. vacuum.

Factory tests allow necessary adjust-

ments to governors, safety devices, etc, as well as insure proper performance with the least amount of adjustment aboardship. It would be impracticable however, for the turbine builder to maintain steam-generating and condensing facilities to load-test large turbines. We make only sufficient tests to assure satisfactory operation.

Before assembly of components, each part that will be under steam pressure is hydraulic checked at several times the normal steam value. We inspect it while under pressure. After assembly the maneuvering valve is checked by observing its operation under conditions simulating normal service. Actuating oil pressure is increased and decreased to make sure all parts are free and in proper condition.

High- and low-pressure turbines get the same tests except that additional equipment is needed to provide vacuum for the low-pressure units. Friction losses of low-pressure blades require exhaust vacuum above 26 or 27 in. Hg to bring larger machines up to speed with the limited steaming capacity available.

In setting the turbine on the stand, main and gland-steam supplies, lubricating oil supply and drain, and exhaust connections are bolted up. Gland drain is connected to an exhauster and testing begins by starting up the condensing system.

A test stand differs from an ordinary power plant in that pipelines are frequently broken, necessitating regular inspection for leaks in vacuum lines. After air leakages have been corrected, opening the throttle slightly starts the turbine rolling at low speed while operators check for rubs with listening rods. The unit comes up to speed slowly and is held at full speed for a vibration check and thorough going-over. Then the rotor gets a centrifugal check at 20% overspeed.

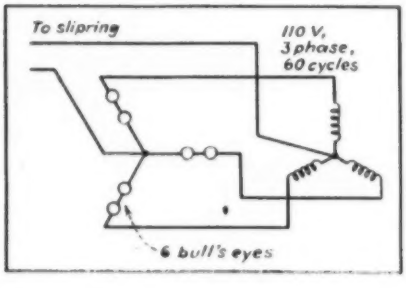


Fig. 4—Schematic diagram of synchronizing-lamp arrangement between slipring of 3-wire dc generator and ac 60-cycle source to maintain exact speed

Fig. 3—Warm-up check for rubbing is followed by full-speed run in order to measure vibration. Each turbine turns up to 20% overspeed before trip is set at 10%

In our machines the overspeed trip is actuated by a small oil pump directly on the shaft of the high-pressure turbine. During the centrifugal test, we record pressure developed by this pump and set the maneuvering valve to trip at 10% above normal speed.

Reduction gears are built to a high degree of precision and are inspected and balanced dynamically before assembly in the case. After an 8-hr full-torque run at relatively low speed, tooth contact is checked.

Typical generating sets, as in Fig. 6, are shop-assembled to form a complete power unit driving its own auxiliaries. We bring these machines up to speed slowly and check them for vibration, general running performance and operation of the lubricating system. The operator then checks all the safety devices including the overspeed and low-oil-pressure trips. The governor is adjusted in accordance with specifications.

The machine is then "run in" at full load for 4 hr and at 125% load for 2 hr. While the unit is still hot, we take the final governor and voltage regulation curves and check the governor for stability and freedom from hunting. Full load is applied and dumped suddenly to check speed response of the governor. Test stand is also arranged so that machines can be operated in parallel for stability check.

Our steam plant is somewhat novel in that boilers are "once-through" or flash type, selected for (1) quick steaming—a boiler can reach full steaming capacity from cold start in 10 min (2) simple shutdown; that is, shut off fuel, feed pumps and fans, and (3) compactness.

Both boilers are rated at 1200 psi, 900 F and can be set to maintain any pressure down to 100 psi. The 10,000-lb-per-hr unit has superheater coils in the radiant zone with boiler tubes in spirally wound coils in a large cylindrical double-wall sheet-metal housing. Air passes through the space between the two walls to enter the furnace with a whirling motion around the burners. Furnace walls and bottom have a refractory brick lining. Four burners are balanced to equalize fuel flow. Steam temperature is controlled manually at any value by injecting water into the circuit.

The newer 15,000-lb-per-hr unit has a separately fired superheater, which is more easily controlled than that of the smaller boiler. The new unit consists of

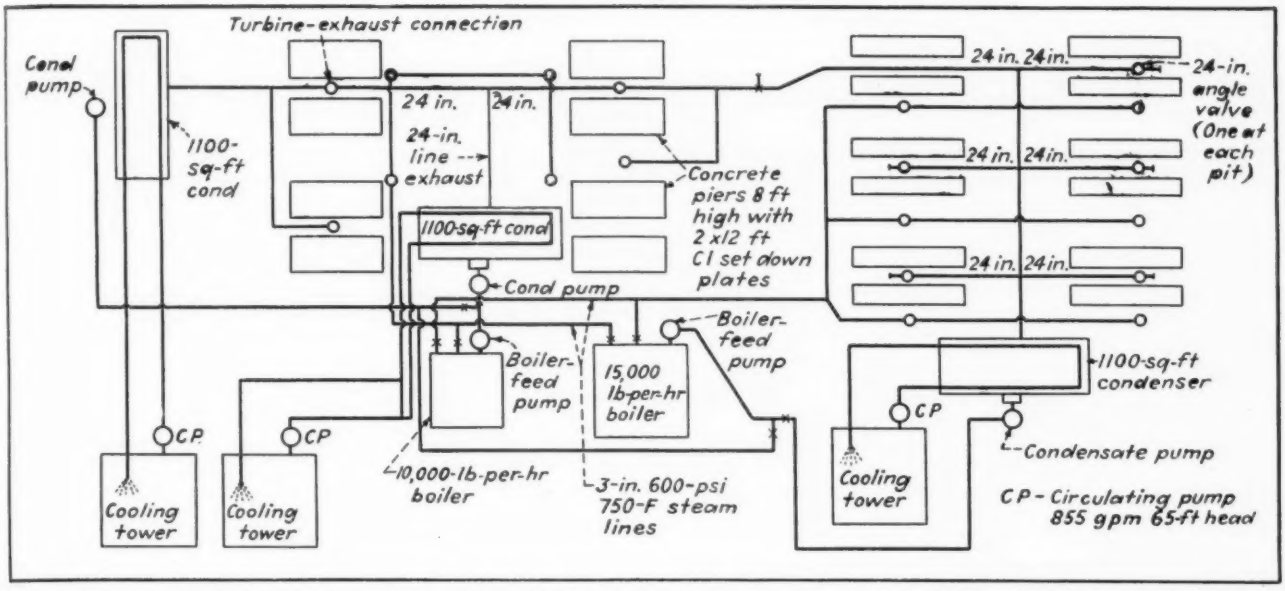


Fig. 5—Vacuum lines for turbine test stand are frequently broken and must be checked for air leaks. Two flash boilers can follow rapid changes in steam demand and hold any desired steam pressure and temperature during load-test run

six saturated sections and two superheater sections in a "package" type assembly with boiler and auxiliary equipment mounted on a common base.

Fuel, air and water to the saturated sections are controlled by operating pressure, as in Fig. 2, while fuel and air to the superheating sections are controlled from outlet temperature. Steam leaves the saturated cells with about 10% moisture, which is removed in a separator.

Flash boilers lend themselves to extreme compactness and there is a tendency to make furnaces very small, which requires adjustment of fuel-air ratio at high steaming rates to assure complete combustion without tarry deposits on the colder tubes. Usually these tubes are closely spaced and such deposits impede the gas passage. Most of the deposits can be blown off with soot blowers but more thorough cleaning is obtained by removing coils and boiling them in a strong caustic-soda solution.

Small furnaces with high heat release per cubic foot of furnace volume operate at high temperatures and it is necessary to use special alloys for straps and other parts not directly cooled by water. In some cases refractory parts must be designed so they are free to expand and contract with changes in temperature.

Supply of steam, however, is only part of the turbine-test problem. Dissipation of the electrical energy produced can present equally difficult hurdles, particularly if space is limited. Because of their flexibility and infinite range of steps up to full load, water rheostats offer the most practical solution. However, our available space allowed insufficient room to raise and lower electrodes in the tanks.

With electrodes and tanks in a fixed position, we vary load by controlling height of water in the tanks by valves at both inlet and outlet, an unusual but satisfactory procedure. Water discharge is circulated through a cooling-tower system.

Another interesting feature is the method of holding constant speed on the turbine-generator sets during load runs. The 300-kw dc units have a 6-pole 3-wire generator operating at 1200 rpm. To obtain a highly accurate and easily visible indication of rated speed, we connect a set of synchronizing lamps to the sliprings, Fig. 6, to compare generator rpm with an outside 60-cycle power source. We have found this unusual adaptation of an alternating current tool to testing direct-current machinery entirely satisfactory.

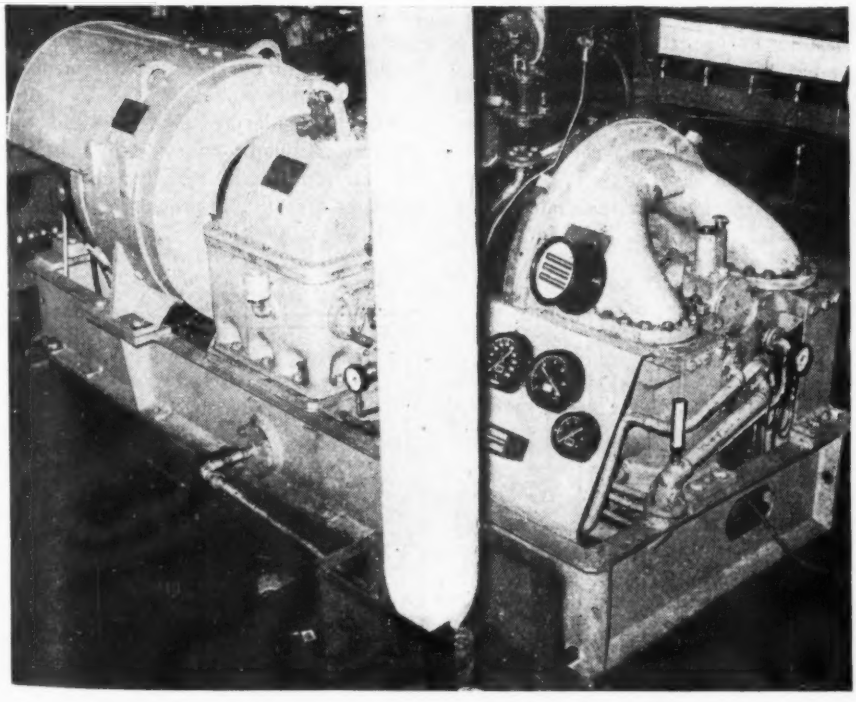


Fig. 6—Typical dc package-type marine set, driving its own auxiliaries, is fully checked before "run in" at full load for 4 hours and 1¼ load for 2 hours

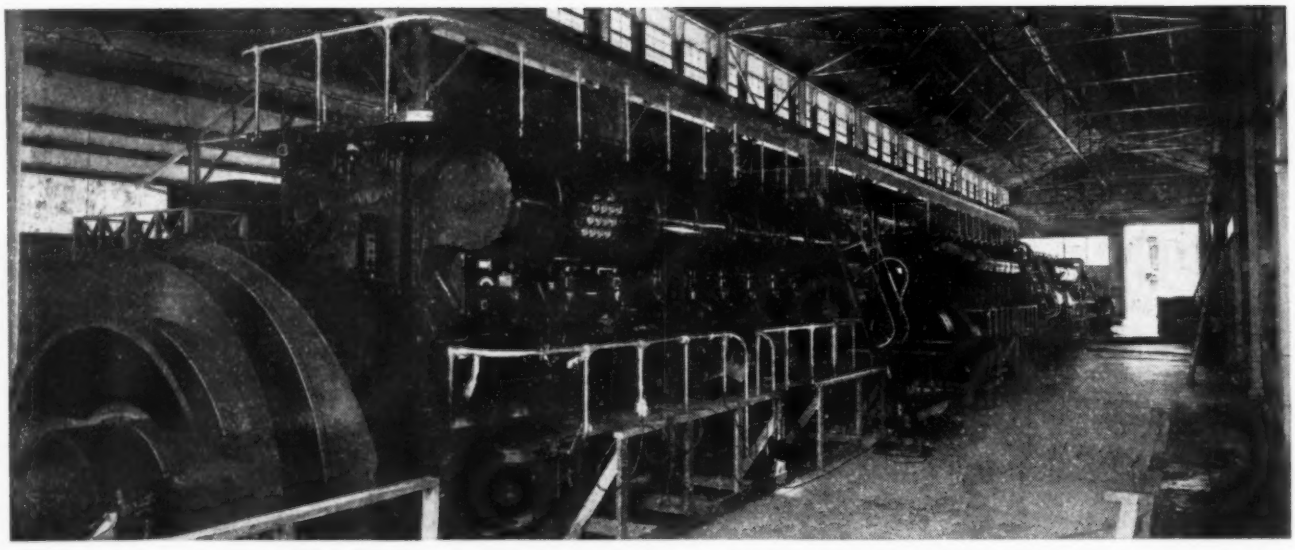


Fig. 1—Three of the seven 3550-hp diesel engines, driving 2500-kw 11.5-kv ac generators, load tested with a water rheostat before the plant was connected to its permanent distribution system. Rheostat provided loads from 50 to 110% generator rating

Water-Rheostat Load Tests 2500-Kw Diesel-Driven Generators

When load was not available for acceptance tests on seven 3550-hp diesels driving 2500-kw 11.5-kv generators in two Panama Canal plants, John L King, electrical engineer, special engineering division, tells how a water-rheostat load was designed that served ten weeks

▶ We faced the problem of making acceptance load tests on seven 3550-hp diesel-driven generating units before their switchgear was installed or power lines constructed. This required a balanced 3-phase load adjustable between 50 and 110% of full-load rating of the 2500-kw 3-phase 11.5-kv generators.

Because plant location made it impossible to use three electrodes suspended in a large body of water, we decided to construct for the job a rheostat load box that would absorb output of one generator. We searched available literature for designs but none was readily adaptable to a rheostat for our load. We therefore designed a box rheostat that used a limited amount of fresh water and checked its performance on a laboratory model.

After considering a delta- and a Y-connected load for the water rheostat, we selected the latter. Its chief advantages are: (1) It provides a neutral

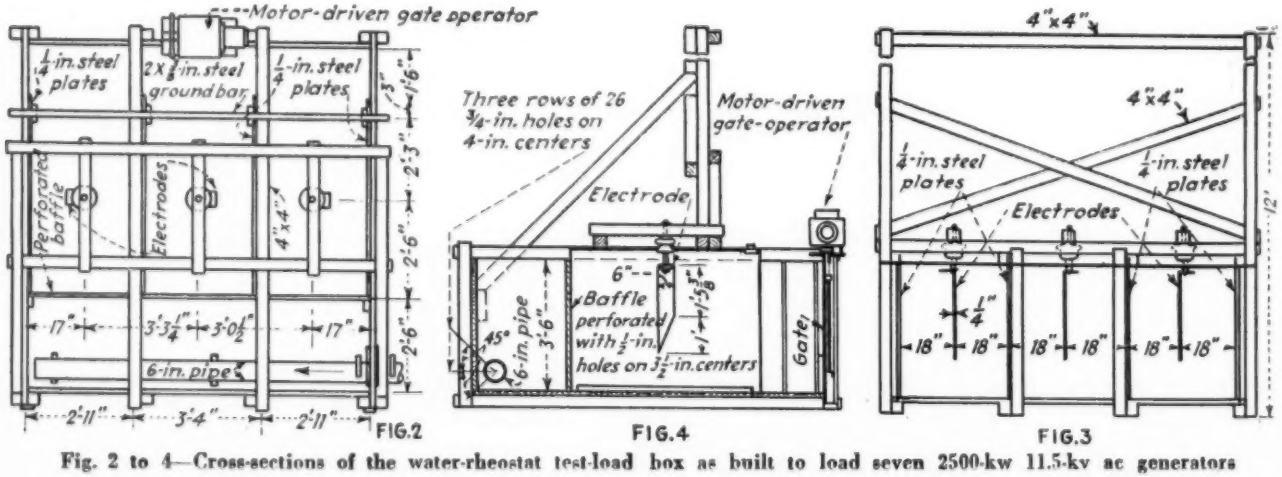


Fig. 2 to 4—Cross-sections of the water-rheostat test-load box as built to load seven 2500-kw 11.5-kv ac generators

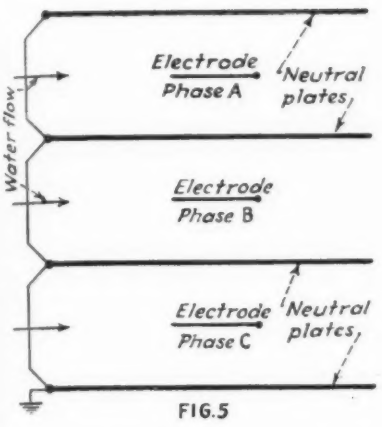


FIG.5

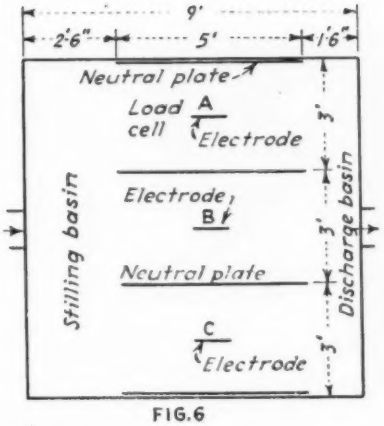


FIG.6

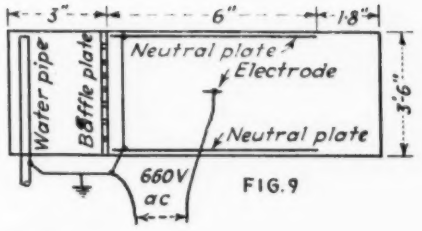


FIG.9

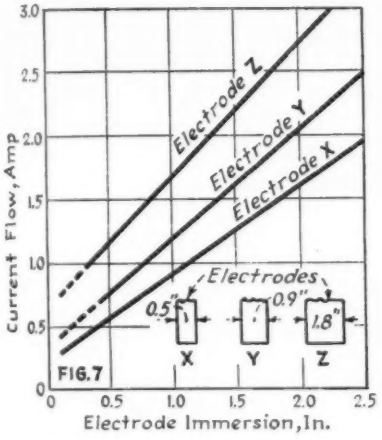


FIG.7

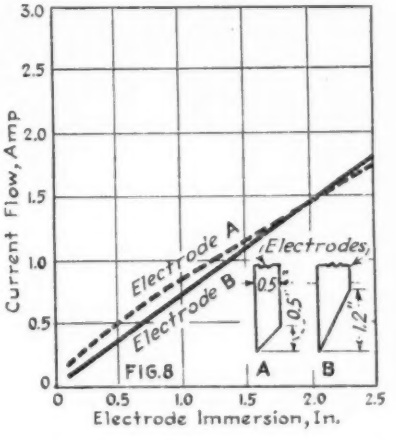


FIG.8

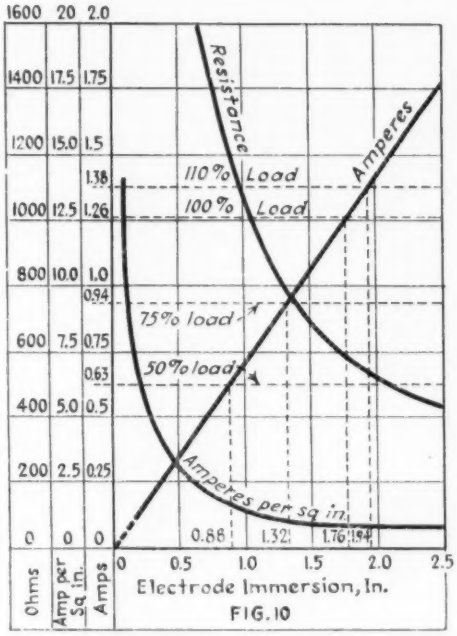


FIG.10

Fig. 5—Electrode and neutral-plate arrangement and fluid-flow direction in the water rheostat. Fig. 6—Design dimensions for preliminary model tests and studies. Fig. 7—Current flow obtained for three different sizes of electrodes used in preliminary model tests. Fig. 8—Current flow obtained with two modified electrode designs. Fig. 9—Diagram of final model to determine load-box performances. Fig. 10—Operating performance of the final load-box model

connection for grounding. (2) Electrode spacing is well adapted for water circulation. Electrode-and-neutral-plate arrangement and water-circulating path, Fig. 5, were tentatively decided upon before making design calculations or model tests.

Size and shape of load box were determined for a 3-phase 60-cycle 240-rpm 30-pole generator rated 2500 kw, 0.70 pf, 11.5 kv, 125.6 amp, full load at unity power factor. Generator was Y-connected with ungrounded neutral. Raw water was available that had 3100-ohms resistance per cu in., at an initial temperature of 85 F, and limited in quantity to 400 gpm. Treated water up to 350 gpm was also available with a resistance of 2600 ohms per cu in. and initial temperature of 84 F.

Rheostat Calculations

When making our calculations, we determined the submerged neutral plate area by assuming a full-load current density at the plate of 0.06 amp per sq in. Full-load current equals 125 amp and there are two neutral plate surfaces for each electrode, Fig. 5. Therefore, submerged area of one plate equals $125 \div (2 \times 0.06) = 1040$ sq in.

We determined plate depth in the water by assuming a 60-in. length, which gives a depth of $1040 \div 60 = 17.34$ in.

We found distance between electrodes and neutral plate by assuming a current density between electrode and plate of 0.12 amp per sq in. Therefore, with raw water and 11,500 v, the distance equals $11{,}500 \div (1.732 \times 3100 \times 0.12) = 17.8$ in. We made this distance 18 in. to simplify construction, and placed the lower end of the electrode 12 in. from the box bottom. From these calculations, we selected preliminary box size and arrangement, Fig. 6.

To check our calculations we built a scale model, reasoning that such a model of one phase of the load would have electrical characteristics similar and proportional to those of its prototype. To make the conversion easy we used a model scale 0.1 actual size and 0.1 generator voltage. Neutral-plate calculated dimensions were the basis for a series of model tests to determine electrode size and shape. We used three test-electrode sizes. Fig. 7 gives their width and current flow curves for different immersion depths.

From these curves and observation of the model performance we decided that a narrow electrode would be the most satisfactory, also that light-load electrode immersions would not be sufficient to prevent gassing and steaming from causing excessive arcing with serious load variations. We therefore tried two pointed-end electrodes in the model. Fig. 8 shows electrode shape and current-flow curves for different immersion depths.

Load-Box Design Details

Fig. 2 and 4 show load-box design details from our calculations and model tests. Shape and proportional dimensions selected for the model were used for design dimensions. In Fig. 2 a perforated ¾-in. board baffle 30 in. from the rear wall and extending the full height of the box formed a stilling basin. Water flowed from this basin to the electrode cells, through 0.5-in. holes in the baffle, spaced on 3.5-in. centers over its whole area.

Water was brought into the stilling

basin by a 6-in. pipe. It had ¾-in. holes bored in it, spaced on 4-in. centers, and arranged in three rows of 26 each. The rows were drilled 45 deg apart and the pipe was placed 3 in. from the bottom, near the wall of the basin with the holes facing the rear wall.

When the detailed design was completed we made to scale a one-cell model, Fig. 9, with water pipe, stilling basin, baffle board and load cell. Using raw water in this model we determined current flow, current density and resistance for different depths of electrode immersions. Fig. 10 shows curves obtained from these tests. Current variation was used as a comparative value for checking load-box operation.

After completing the model tests we built the load box, Fig. 11, and made several tests to check its hydraulic characteristics before applying voltage. The box was then connected to a generator through a temporary line, ready to provide test loads.

Discharge Gate

During operation water flowed continuously through the box from the stilling basin, then through the perforated baffle to the load cells, from which it flowed over the top of a discharge gate, Fig. 13. To dissipate the heat, this arrangement gave a constant flow of cold water between electrodes and neutral plates. Discharge over the gate top kept the water surface free of foam.

Comparison of Model Test and Box Operation

Full Load	*Electrode immersion, inches*	
%	*Model*	*Prototype*
50	8.8	9.5
75	13.2	14.0
100	17.6	18.2
110	19.4	20.5

Raising or lowering the discharge gate with a motor-driven valve operator varied the water level to make load adjustments. Limit switch *L*, Fig. 12, kept gate travel and water level in the box within a range of 20 to 120% full load on the generator.

When the box was put into operation using raw water, the voltage was raised very slowly with the water level set at about 25% load. Some steaming and gassing were observed on the downstream edge of the electrode. An arc formed under water at the electrode point; also arcing and burning occurred at the water surface near the electrode. We assumed that the burning was combustion of hydrogen with oxygen formed by electrolysis. Since the arcing or gassing caused no damage or other trouble, water level was raised to increase the load to 50%. This increased the gassing and steaming, but the arc at the electrode tip almost disappeared, presumably from increased water pressure. There was little or no arcing at the water surface and the box appeared to function correctly, so it was put into service.

During tests, which lasted several weeks, we encountered no difficulties, but after about two weeks of actual operation the ends of the electrodes were so badly burned, Fig. 14, that the load could not be held constant. New electrodes were installed, which gave a balanced load and stable operation. Electrodes were subsequently replaced at the end of each 2-week operating period.

Electrode Immersion

Electrode immersion at various loads compared to model test results is shown in the table above. Prototype performance compares closely with predictions based on design calculations and model tests.

After completing engine tests in one plant we moved the load box to the other and set it up. Here the raw water had such a high salt content and low resistance (510 ohms per cu in.) that we could not use it without redesigning and rebuilding the water box. We therefore used treated water that had resistance of 2600 ohms per cubic inch compared to 3100, for which the box was designed. With treated water in the load box, excessive arcing occurred at

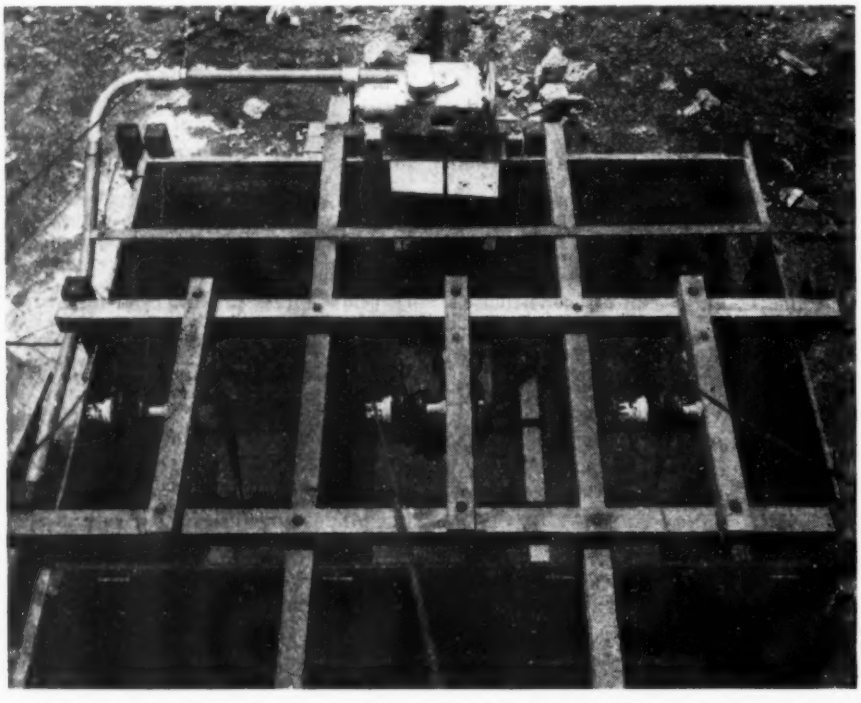


Fig. 11—General construction, arrangement of the three electrodes and power-operated control gate are shown in this view looking down in the water rheostat

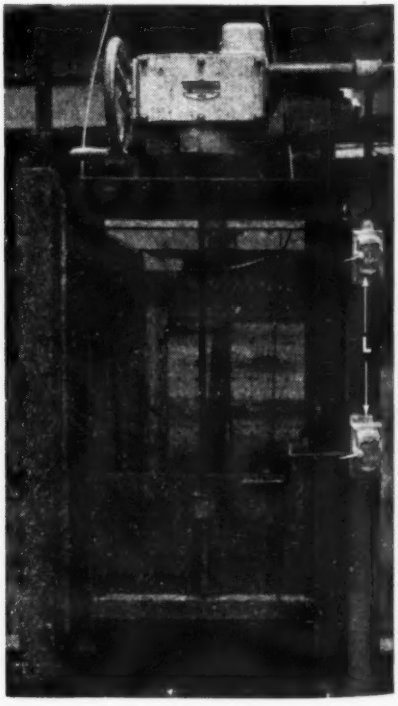


Fig. 12—Motor-driven control-gate operator at top, and limit switches at *L*

the water surface with intensive steaming and gassing at the electrodes. Voltage to neutral could not be raised above 4500 without arcing over the water surface to ground, which we assumed was caused by chlorine added to the water during treatment.

Used Treated Water

To study this difficulty, we again used the model and samples of the treated water. In these tests excessive boiling and arcing occurred, and we decided that by lengthening the current path we could duplicate operating characteristics with raw water at the first plant. When we tried this in the model, a strip of insulation 3.6 in. wide placed over the center of each neutral plate gave the required results. Fig. 15 shows the location of the insulation strips.

After insulating neutral plates in the load box with sheets of glass, we tried the experiment again. The box performed satisfactorily in regard to arcing but current flowed to ground through the box bottom and set the wood on fire. We substituted rubber floor matting for the glass plates. It extended in a strip 3 ft wide over the center portion of one neutral plate, 5 ft wide, down across the cell bottom under the electrode and up in front of the other neutral plate, Fig. 16. Thus the problem was solved and the box put into service.

Performance of the water rheostat load box was highly satisfactory. It was used for about ten weeks at loads from 625 to 2750 kw at unity power factor. During the test on each machine, full load at rated voltage was instantaneously removed and applied several times. This gave the load box an opportunity to flash to ground or show other defects, but none developed. During continuous operations, load could be held constant for long periods of time with equal phase-load distribution. Only difficulties during operation occurred, as previously mentioned, when the electrodes became badly burned at the tips.

We believe that this box, or a modification, could be used satisfactorily under similar conditions without making a complete new study. If the same current density in the box were maintained in the water, size could be altered to suit almost any load current and voltage by adjusting the dimensions accordingly.

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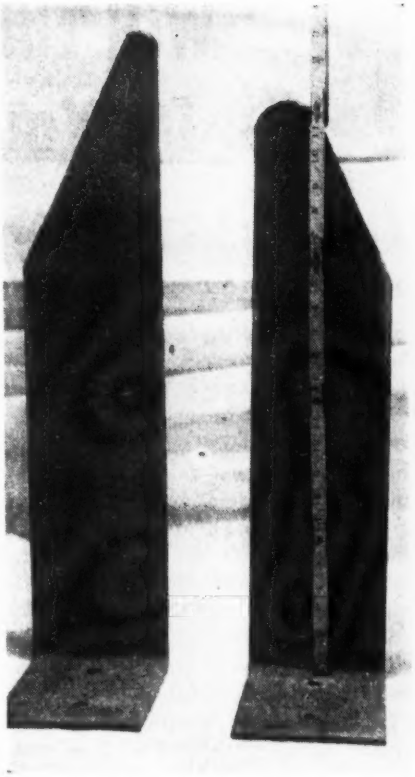


Fig. 14—After about two weeks' service immersed ends of the electrodes were so badly burned that the load could not be held constant and they were renewed

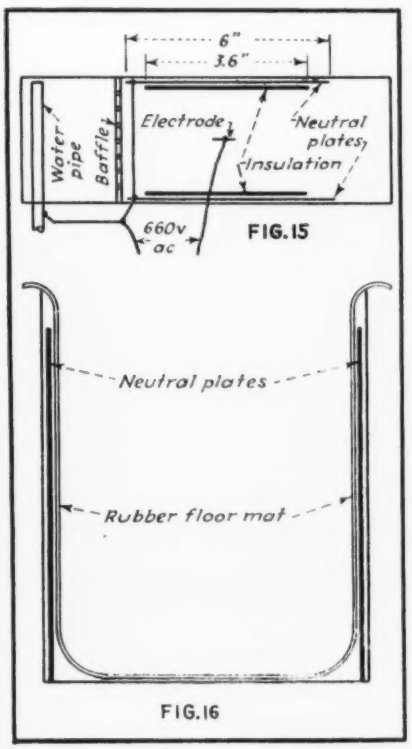


Fig. 15—Diagram of model used to test effects of insulation in front of neutral plates to help regulate load when using treated water in the rheostat. Fig. 16—Arrangement of rubber floor matting in water load box to stop current leakage through its wooden bottom

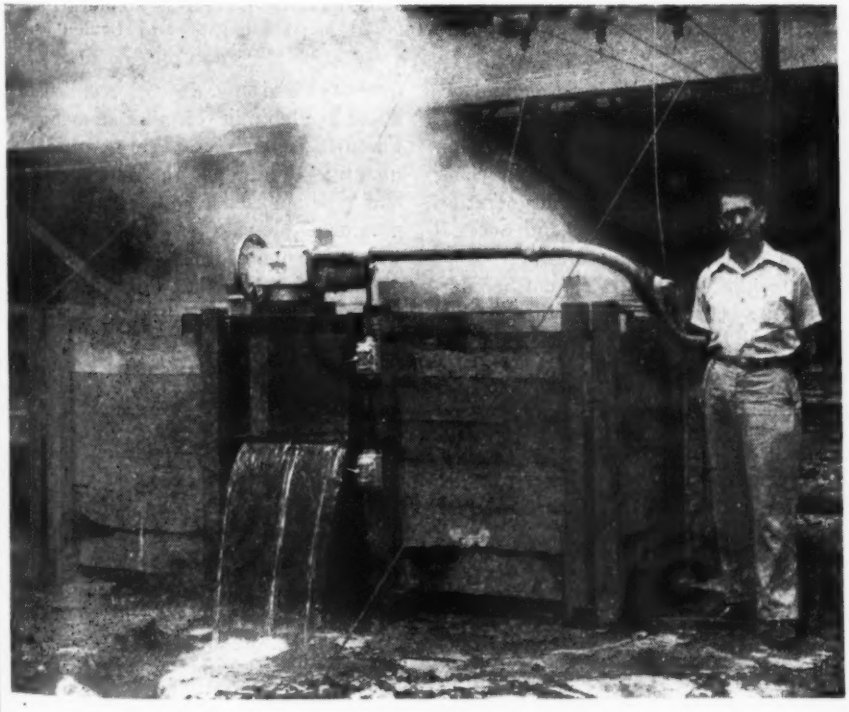


Fig. 13—Author standing near load box during operation at 50% load. Note the water flowing over the control gate and the steam rising from the water surface

Will the Proposed Equipment Do Your Refrigerating Job?

Yes, if you take into consideration the problems involved and carefully compare the machinery bids before making final selection, says John D Constance. Here he tells how to avoid pitfalls that lead to future operating troubles

► INTELLIGENT COMPARISON of bids tendered for furnishing refrigerating machinery requires not only a full knowledge of plant operating problems but also a close acquaintance with the machinery offered by each bidder. Tabulated capacities and dimensions of principal equipment submitted by each bidder are complete as far as they go, but each unit must be considered for its real value to the purchaser.

For example, a reciprocating compressor cannot be judged by bore and stroke alone. Its volumetric efficiency must be known because this is a measure of its refrigerating capacity for a given cylinder displacement. With high volumetric efficiency, needed refrigeration capacity can be obtained from a smaller cylinder and, other things being equal, from a machine of lower cost. Also consider the compressor's mechanical design to make sure it can do the work required with minimum maintenance.

Volumetric efficiency also influences power required to drive the compressor. The lower a compressor's volumetric efficiency the lower will be its mean effective pressure. Since mep is directly proportional to rate of work done, low mep means less input. This, in turn, means that of two compressors having the same cylinder dimensions and speed, the unit with lower volumetric efficiency can be driven by a smaller motor or engine. Thus drive size should always be proportioned to volumetric efficiency.

Absorption-machine performance cannot be evaluated by evaporating area in the stills or by the square feet of cooling surface in the absorber. In itself, area means nothing, but when related to other factors it becomes important. Determine the ability of given apparatus to do a unit of work with a given amount of steam, within a certain pressure range and with a given amount of cooling water. This is the true measure of the unit's value to the buyer.

Consider absorption-machine design to insure continuous operation and accessibility for repairs and renewals. Once equipment is installed design peculiarities determine over a long period both maintenance and operating costs, which may be high and necessitate a large operating crew.

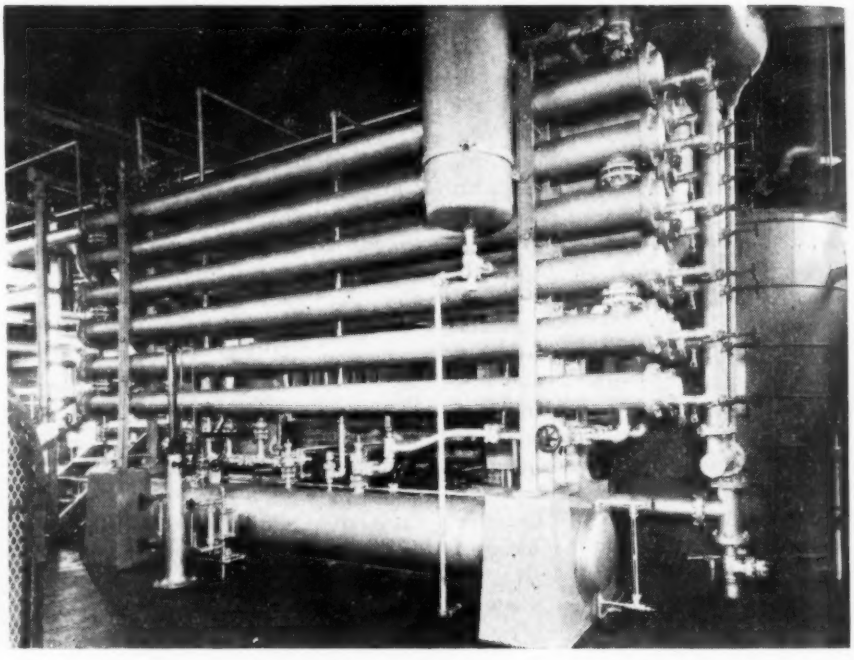


Fig. 1—Temperature and available cooling-water quantity determine condenser area and type selected—whether multi-pass (*above*) or single-pass and baffled shell

Ammonia condensers cannot be compared by considering only the number of coils or feet of tubing. Efficiency per square foot of surface is the true measure of value. When pipe or tube walls are relatively thick a considerable difference in tube area offered to do a given amount of work may result, depending on whether the heat-transfer coefficient is applied to inside or outside surface. Number of Btu absorbed by condensing water per square foot of surface per hour for each degree of mean temperature difference between the ammonia and condensing water determines apparatus economy and its value to the purchaser.

Consider temperature, as well as quantity and quality of condensing water available in selecting ammonia or Freon-12 condensers. Temperature and quantity determine the surface area and type selected whether it be multi-pass or single-pass and baffled shell. If water is plentiful in comparison to quantity of refrigerant to condense, the former should pass through the tubes and the latter through the shell.

Close baffling increases the gas velocity across the tubes, which gives greater over-all heat transfer. Water quality determines type of condenser, that is, non-corrosive water permits removable-bundle hairpin-turn tubes, whereas corrosive water calls for non-clogging or straight tubes to provide accessibility for cleaning. Ammonia condensers use steel tubes and shells; copper ones are subjected to dissolving action of ammonia. Freon-12 condensers have copper tubes and steel shells.

Number of square feet in the evaporator's working surface as specified by

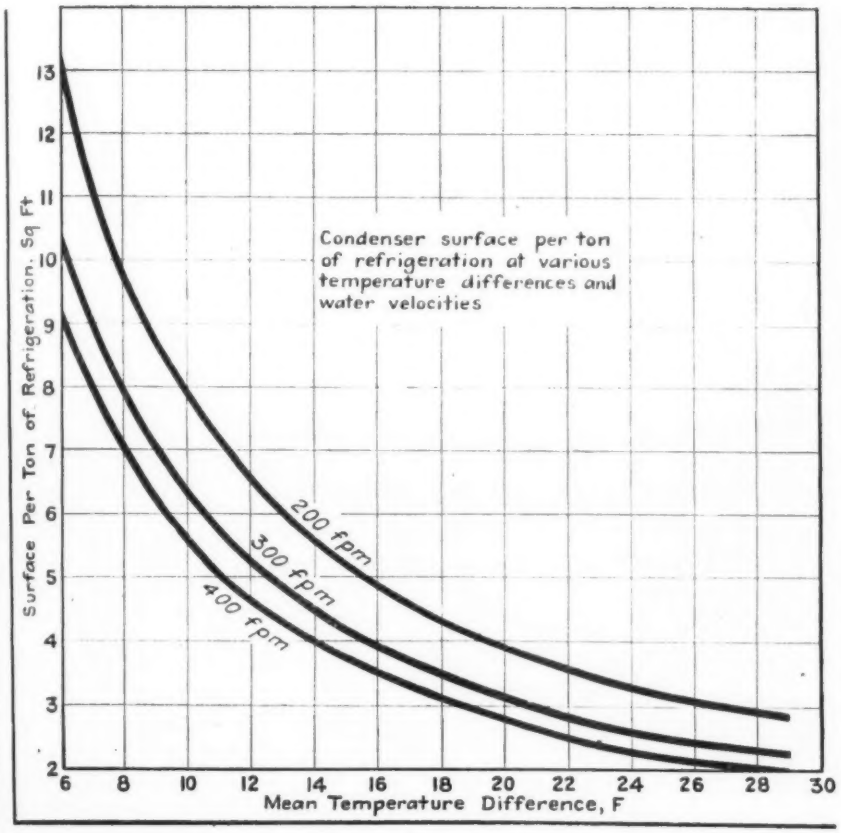

Surface Per Ton of Refrigeration, Sq Ft
Condenser surface per ton of refrigeration at various temperature differences and water velocities
200 fpm
300 fpm
400 fpm
Mean Temperature Difference, F

Fig. 3—Condenser may be made to handle several tonnage capacities, each depending on discharge-water temperature. Velocity also affects the surface needed

a bidder is not so important as the heat that each square foot absorbs per degree difference in temperature. Whether heat-transfer surface is copper, steel or muntz metal, heat-transfer rate is not affected materially if all other conditions remain the same. These metals offer mechanical advantages in design because of their individual ability to withstand corrosion.

Each part must be properly connected to make a complete system and the whole properly incorporated into other parts of the plant. Make accessibility and ease of maintenance the watchword here.

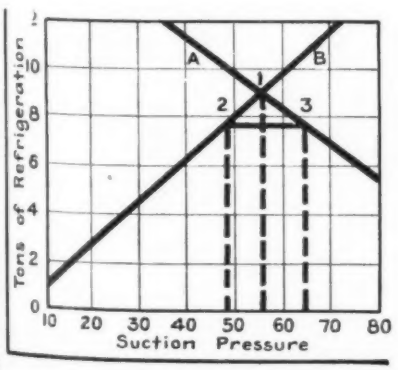


Fig. 2—Before selecting point 1 as combined evaporator and compressor suction pressure, consider pipe friction

Proportion the evaporating system to the connected refrigerating compressor's needs. Separate performance of compressor and coil can be computed easily, but once the two are installed and connected the situation changes. Then compressor and coil act as a single unit, and every operating change in one affects the other; performance of the combination depends upon their individual characteristics. If a compressor is selected for some given refrigerating load and suction temperature, the evaporator must have the same capacity at the same suction temperature.

Thus, a decrease in compressor speed reduces its capacity. If coil area could be decreased in proportion to reduction in load, suction pressure would remain unchanged. But if the compressor connects to a coil having a fixed surface, as is almost always the case, suction pressure increases as compressor speed decreases because the cooling coil temporarily continues to vaporize more refrigerant than the compressor can remove at reduced speed.

Suction pressure and temperature gradually increase until eventually the coil's capacity reduces to that of the compressor. Although there is a reduction in the system's refrigerating capacity it is less than if the suction pressure had been maintained at the original value by decreasing the coil area with compressor speed.

Such changes are difficult to visualize. Their effect on combined cooling coil and compressor operation is sometimes awkward to analyze because various compensating factors offset changes caused by other factors.

Combined Capacity

In Fig. 2, curve *B* represents the capacity of a compressor operating at fixed speed, but against different suction pressures. Curve *A* represents the capacity of a given coil for one entering-air temperature and velocity, but at different suction temperatures corresponding to various suction pressures. If a coil and compressor of these characteristics are connected what will their combined capacity be and at what suction temperature will they operate? Selecting point 1 implies that evaporator and compressor suction pressures are the same. Practically, this condition does not exist because piping friction makes evaporator pressure higher than that at the compressor, as indicated by line 2-3 whose length is proportional to suction-line pressure drop.

To arrive at the working value of an evaporating system requires a full knowledge of how that system is to be connected and operated. An expansion system, or one where refrigerant leaves the coil slightly super-heated, requires about one third more surface than a wet-compression system. In the latter, refrigerant leaves the coil carrying sufficient entrained liquid to maintain wet compression.

A flooded system is one wherein the refrigerant flows through the coils and into a trap, where the gas is separated and passes on to the compressor. The liquid recirculates through the coil together with fresh liquid fed into the trap. To do the same amount of work, such a system requires only about one half the evaporating surface needed for an expansion system. However, the flooded system requires a greater initial charge of refrigerant with attendant higher losses if leakage occurs. Obviously buying an evaporating system on a square-foot basis, without knowing how the system is to be used, is likely to get the purchaser into trouble. First costs must be balanced against operating and maintenance costs to arrive at an intelligent answer. The more com-

pact and simple a plant, consistent with durability and operating cost, the more valuable it becomes to the purchaser.

But who is to decide these technical questions? Unless the purchaser is a competent engineer he should obtain good engineering advice. The investment is large and a mistake costly.

When comparing bids for compression machinery investigate compressor clearance and see whether the valves have sufficient area and are properly balanced. Look into inlet connection design and its effect on pressure drop. When it became apparent that Freon-12 would be used extensively in air-conditioning and marine service units, tests were run on standard ammonia compressors using Freon-12 as the refrigerant. Results indicated that Freon-12 was more viscous than ammonia under the same conditions. Since approximately four pounds of Freon-12 to one pound of ammonia circulates per ton of refrigeration, importance of streamlining at all points can be readily appreciated.

In the past the question of wet and dry compression was passed over as if it had nothing to do with compressor performance. Quite often, too, the horsepower per ton of refrigeration was not given serious consideration. However, wet compression is practically obsolete because of control difficulties and condensation within compressor cylinders that caused crankshaft and piston troubles on startup.

Investigate Conditions

Different types of refrigerant condensers have their particular peculiarities which must be weighed one against the other. Evaluate these characteristics and investigate conditions under which the condenser will operate before making final decision. Again, as in evaporator selections, expected performance must be balanced against expected load. Knowing the load, select a condenser to handle the required number of tons of refrigeration at the desired condensing pressure and temperature with available water at known temperature and flow.

Curves in Fig. 3 show that a condenser may be made to perform at several tonnage capacities, each depending upon condenser discharge-water temperature. Ratings are based upon the assumption that the tubes are reasonably clean. Also indicated is the value of a square foot of condensing surface through the various conditions.

The curves also show effect of water velocity through the tubes and mean temperature difference on the square feet of condensing surface per ton of refrigeration. Using about 15 sq ft of condensing surface per ton of refrigeration allows enough spare surface so that water-passage fouling need not become too serious over a 3-month period unless cooling water is extremely bad. A flat allowance per ton is not good engineering because different operating conditions require different treatment.

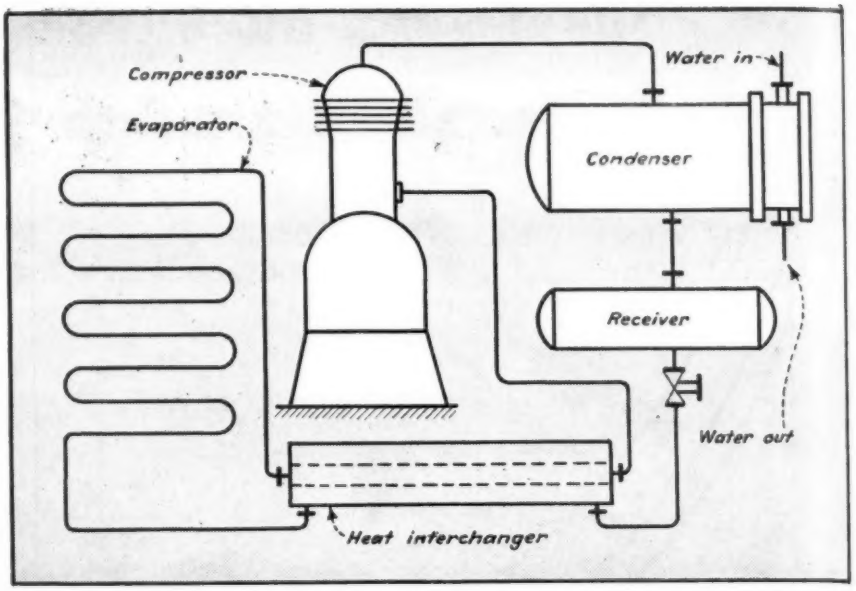


Fig. 4—The liquid-gas heat exchanger precools the refrigerant, which gives it more heat-absorbing capacity as it enters the low-temperature evaporator coils

If water is scarce, cooling surface must be larger. Increasing the condensing surface and working through a greater temperature range helps. However, exercise care to prevent too high a condensing temperature with attendant increased power costs per ton of refrigeration. If inlet water temperature is high guard against high condensing pressure and temperature. Take advantage of low entering water temperature and use less condenser surface. Here condensing pressure must be watched for an entirely different reason: Too low a condensing pressure slows the flow of refrigerant through the pipeline, expansion valve or float and through the evaporator.

Now a few words on compressor rating. Determine refrigerating-compressor ratings by test and correct for actual liquid temperature at the expansion or float valve. Thus, since the compressor knows only volume, cubic feet of gas handled between specific pressures is the same whether a liquid at one or another temperature is expanded. Knowing liquid and evaporator temperatures, heat content may be determined from refrigerant property tables and the actual pounds of refrigerant computed.

Compressor volumetric efficiency is affected mostly by design and varies with different machines. One item of importance is: Just what is the gas density at the start of compression? Be careful when comparing compressor performance from this angle. Some manufacturers rate their units without so-called liquid-gas heat exchangers, Fig. 4, while others offer performance figures and neglect to indicate that the tests were performed with exchangers in the circuit. Thus, a person not familiar with conditions will immediately select the unit rated with an exchanger in the circuit.

For instance, superheating the suction gas by extracting heat from liquid going to the expansion valve or by useful work in the evaporator shows more gain from increased heat-removal capacity than loss from the greater volume per pound of gas handled by the compressor. A liquid cooler increases volumetric efficiency 1% and superheats the gas 1.66 F for each degree of liquid cooling, but it does not give this gain twice. Thus if the gain is realized in the heat exchanger it cannot be completely realized again by superheating the vapor in the same cycle in the evaporator. Expressed simply, increase in volumetric efficiency is less than 2% if superheating occurs in both places.

Superheating inside the evaporator by cooling incoming liquid shows a gain of (1% ÷ 2 F) x (1 ÷ 1.66) or

(*Continued on page* 144)

Experiences From the Notebook Of a Centrifugal-Pump Service Man

B L Cody, Allis-Chalmers pump engineer, draws on service men's experiences to tell the story of pump installation and give causes of poor performance. While some of the faults are unusual they are potential causes of avoidable trouble

▶ CENTRIFUGAL-PUMP TROUBLES can usually be traced to pump materials that are incorrect for the liquid handled or to improper application, operation or maintenance. Perhaps when something happens to your pump these notes from service men's reports may enable you to solve the problem. Of course all the trouble did not occur on a single pump, as in this continuous story, but that does not subtract one iota from its value in helping to avoid pump troubles and insure good service from the installation.

On his arrival at a customer's plant, the pump-service man contacted the chief engineer. So serious was the trouble that they carefully studied the whole pumping installation beginning at the suction well. The pump takes its suction from a sump supposedly protected from the river by a trash screen. However, when the screen was lifted a considerable portion of it had corroded away because during high tide this section of the river is quite salty. At the service man's suggestion, the customer agreed to provide a screen that would not corrode and allow trash to come into the suction well.

Cleaned Suction Well

Because of the screen's bad condition they decided to block off the suction well and pump it dry. In the well bottom they found a large quantity of old rags, paper and other trash, also a large section of roofing paper torn from the pumphouse roof during a high wind. This material could be pulled up against the suction-pipe screen to increase the pump's suction lift seriously. Since this caused noisy operation and reduced pump capacity, the customer agreed to provide a cover for the sump.

A trouble not commonly found was a barnacle growth all over the foot valve and suction screen, which restricted suction inlet area to about 50% of normal. To eliminate this condition, sump and foot valve will be inspected regularly.

An auxiliary suction line was found connected by a tee in the main suction but was not then being used. There was a valve in the main line adjacent to the tee on its suction-well side and another in an auxiliary line about 15 ft from the tee. Fig. 1. Location of the latter accounted for the pump losing its prime, when primed by backfilling. When the main suction line was backfilled air was compressed in the 15 ft of auxiliary suction line. Then when the pump started and pulled a vacuum in the suction line, air in the auxiliary line expanded into the main line and was carried into the pump to cause loss of prime. The customer agreed to install the valve in the auxiliary line adjacent to the tee, Fig. 2, and install both suction-line valves with their stems horizontal to eliminate air

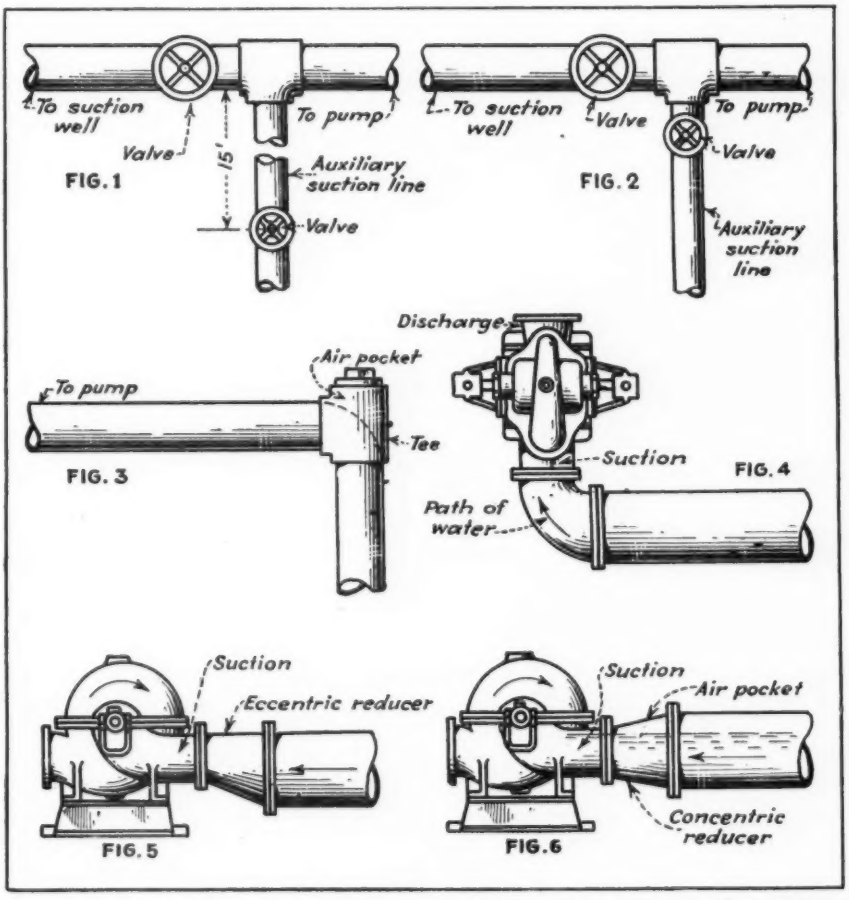
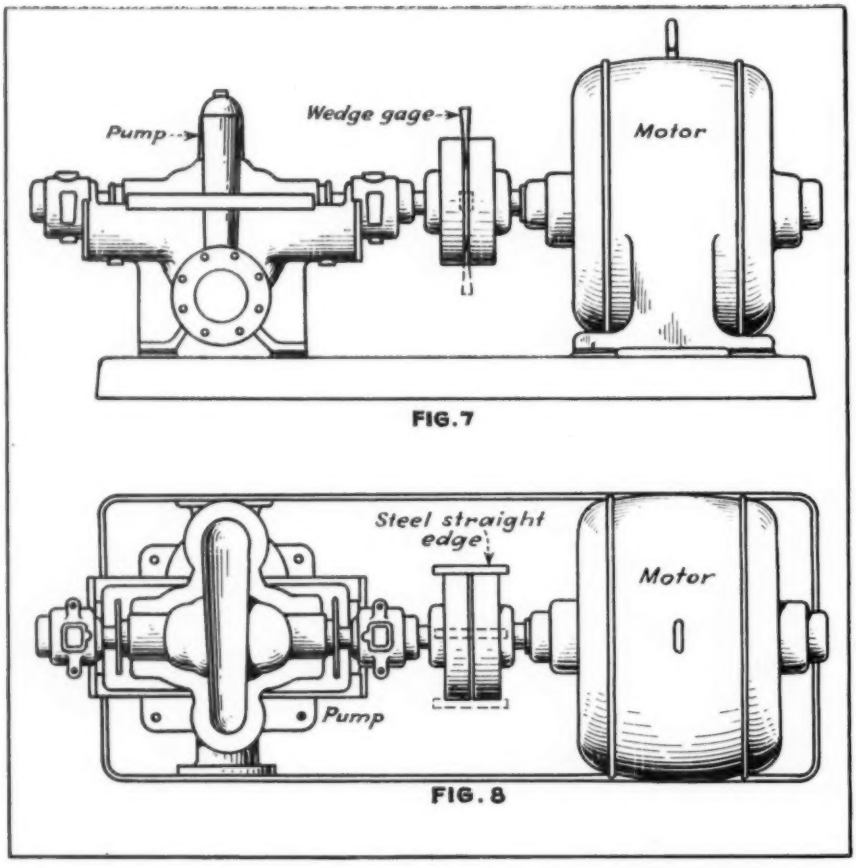


Fig. 1—Wrong location of a valve in the auxiliary suction line caused trouble on this pump installation. Fig. 2—Correct location of valve in auxiliary suction line. Fig. 3—A tee in a suction line provides a place for an air pocket that may cause trouble. Fig. 4—A horizontal bend close to the pump nozzle causes one side of the impeller to get more water than the other. Fig. 5—Bring suction line with eccentric reducer straight to the pump's suction nozzle. Fig. 6—Never use a concentric reducer as it provides space for an air pocket



Check pump alignment with a wedge gage, Fig. 7, between the faces of two coupling halves; and a steel straight edge, Fig. 8, placed on their rims

pockets formed by the valve bonnets when their stems were vertical.

Inside the pumphouse a vertical tee in the suction line was used for backfilling when the pump was primed. The customer agreed to make the priming connection on the discharge side of the pump, also to replace the tee with a long radius elbow. An air pocket could form in the vertical tee, Fig. 3, and restrict flow to the pump. Also it is possible for the air pocket formed in the tee to be carried into the pump and cause loss of prime.

Rebuilt Suction Line

Suction line was installed horizontally and made a right angle bend near its suction nozzle, Fig. 4. Such a bend tends to starve the side of a double-suction pump adjacent to the inside of the bend. This is because water flowing around the bend tends to be forced to the outside; consequently this side of the pump gets more water than the other. Because the suction line had so many potential sources of trouble the customer agreed to rebuild it in conformity, as far as possible, with good practice. In addition to the changes mentioned, the suction line was to be brought straight into the pump and the connection made with an eccentric reducer, installed as in Fig. 5. Never use a concentric reducer, because an air pocket may form in it, as in Fig. 6.

The pump was noisy and vibrated considerably when running. Bad conditions in the suction line undoubtedly caused part of the noise, but to locate the cause of vibration we checked the pump's alignment and found it out in all three directions. Alignment was checked with a wedge-shaped gage between the faces of two coupling halves, Fig. 7, and a steel straight edge on the rims of the two coupling halves, Fig. 8. Adjust motor's alignment with pump until the straight edge rests squarely on the two halves of the coupling top, bottom and side, and the coupling faces are the same distance apart at these four points. Hold these measurements so that the difference between the maximum and minimum of any four does not exceed 0.001 in. when pump and driver have reached operating temperature.

Even though correct alignment of the pump eliminated vibration, minor noises from its operation seemed to be amplified into a deep-throated roar. When searching for the cause, a mechanic happened to hit the bedplate top with a wrench and it sounded like a hollow log. Further rapping of the bedplate indicated that it had not been completely filled with grout. It was suggested that if top of the bedplate were filled with grout it would quiet the pump considerably.

Inspected Inside of Pump

Upon removing the top half of the pump's casing to inspect internal parts, the service man found the cast-iron casing slightly pitted over its entire surface. Worse pitting occurred in the suction-passage side, starved of water, because of the horizontal bend at the suction nozzle. A good part of the suction-casing pitting and also that found in the runner inlet was caused by restricting the suction pipe intake by barnacles on the pipe and trash in the suction well. This made the suction lift sufficiently high to produce cavitation in the pump and also caused noisy operation.

Since the pump was bronze fitted, and during high tide handled salt water, some of the pitting was probably caused by electrolytic corrosion. The customer was advised to install a zinc plate in the suction line adjacent to the pump suction flange. This plate would be acted upon by the pump's bronze parts instead of the cast-iron casing.

Runner passages were fairly clean except for a ¾-in. nut lodged in the inlet to one passage. This threw the runner out of balance and accounted for some of the noise during operation and also reduced the pump's capacity.

Applying a micrometer to the horizontal casing-joint gasket showed it to be about one half as thick as specified in the instruction book. In the shop we bore pumps' casings with a gasket of the same thickness in their horizontal joint as specified in this book. Too thin a gasket in this joint causes pinching of wearing rings and bushings whereas too thick a gasket permits excessive leakage because these parts are loose in the casing.

Inspection of the stuffing box indicated that the pump had been packed before it was assembled. Then when the top half of the casing was bolted down the packing pinched out in the casing joint, Fig. 9, to hold this joint open. Also the horizontal joint gasket was not flush with stuffing box inside surface, and was allowing air leakage behind the packing. Tightening the packing gland only jammed the packing on the impeller shaft to cause over

heating, while water or air flowed around the packing through the casing joint.

At times the water pumped carried considerable silt. This water was used in the lantern ring to seal and lubricate the packing by a connection, as in Fig. 10, and undoubtedly carried silt into the packing, which accounted for some of the packing trouble. The service man recommended that connection *A* to inside of casing be closed and a clean-water supply be connected to *B*.

This insured clean water to the lantern ring. The packing should be operated with the gland nuts finger tight only and valve *V* adjusted to maintain a constant drip of about one drop per second from the gland. As long as water comes out of the gland air cannot leak into the pump and the packing gets sufficient lubrication to prevent excessive packing or shaft-sleeve wear.

One of the shaft sleeves showed machine tool marks. Questioning revealed that a local machine shop had made this sleeve. Its surface should have been ground smooth and buffed to provide a polished surface for the packing to run on to keep wear to a minimum. When we removed the shaft sleeve to see how it was installed, the joint between it and the nut was not packed, and the joint between the impeller hub and sleeve not sealed with a liquid gasket material.

The discharge line did not have a check valve and the gate valve leaked sufficiently to maintain full discharge pressure in the pump casing. This pressure caused water to leak through joint *A* at the impeller hub and shaft sleeve, Fig. 11, along the shaft and out at *B* or into the sleeve bearing on this end of the pump. With suction pressure below atmosphere in the pump during operation, air leaked between sleeve and shaft into the pump to reduce its capacity.

Salt water entering the joint at *A*, Fig. 11, had started etching the shaft. Fortunately this condition was found and corrected by properly sealing the sleeve, or the etching would eventually have caused the shaft to fail at the impeller hub. Galvanic action between the bronze runner and steel shaft in a liquid that acted as an electrolyte caused etching of the shaft. To prevent this, joint *A* must be kept properly sealed or the shaft made of a material that will not etch because of the bronze impeller.

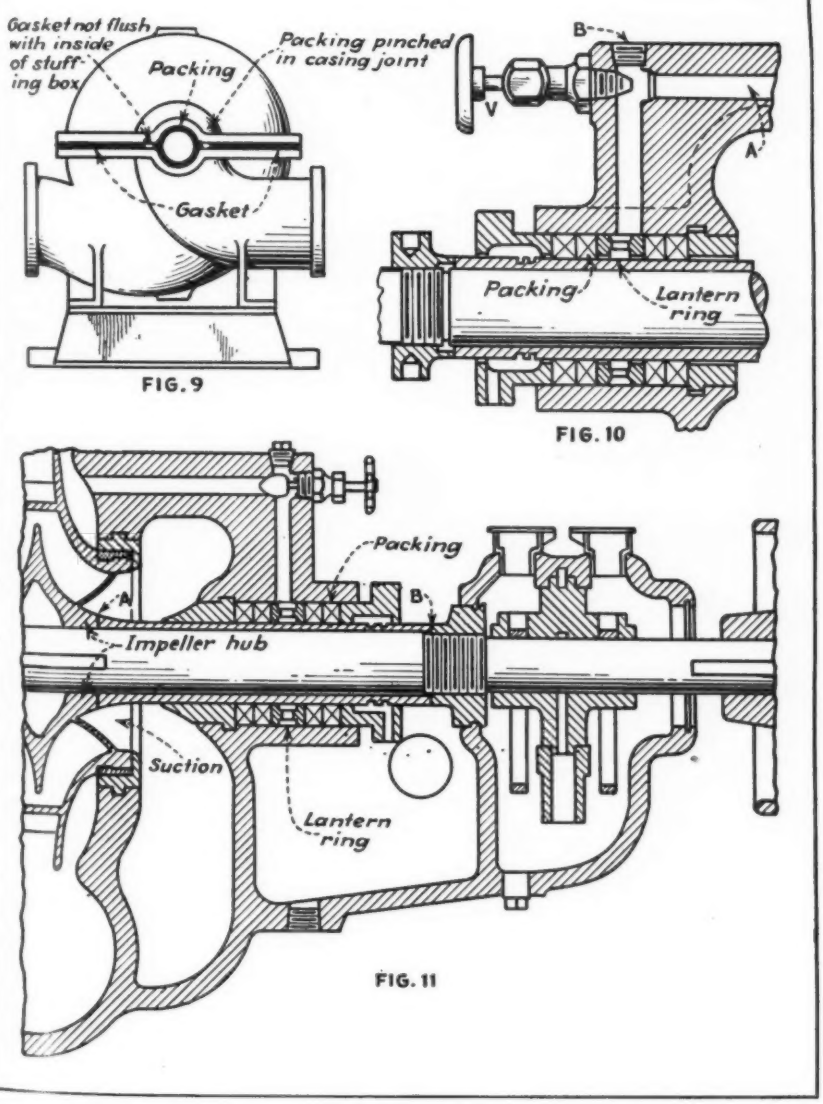


Fig. 9—Gaskets in the pump-casing joint must come flush with inside of stuffing box. Don't pack pump until after it has been assembled. Fig. 10—If pump handles dirty water close opening *A* and connect *B* to a clean water supply to keep dirt out of the lantern ring. Fig. 11—Unless the shaft sleeve is properly sealed at *A* and *B* air or water can leak through between the sleeve and shaft

Specifying a Pump

When the customer purchased the pump he should have specified an all-iron or all-bronze pump. Or if he needed advice he should have given the manufacturer a chemical analysis of the water. Never let him take such an analysis for granted. Often it is assumed to be just river or salty-bay water, when upstream some plant is dumping refuse that changes the water's chemical content from that assumed. Such a change in the water may make the materials in the pump selected for the assumed condition unsuited for those that actually exist.

Trouble had been experienced because the grease-lubricated ball bearings on the pump ran hot. On dismantling the bearings the service man found that they contained so much grease that it was flowing out along the shaft through the seals and causing the high temperature. The men in this plant had developed the bad habit of thinking that if a little grease is good, a lot is better—a belief handed down from the days of slow-speed machinery and sleeve bearings.

When a high-speed antifriction bearing is full of grease the balls or rollers are continually pumping the grease out of the races. Energy thus expended may cause excessively high temperature in the bearing. This customer's trouble resulted from not following the instruction book, which recommends only enough grease for the bearings to be half full when the retainer cap is in place.

Steam-Jet Thermocompressors Supply

Mr Freneau continues his discussion of no-moving-part devices that reclaim heat from exhaust or low-pressure steam by boosting its pressure with energy from main-steam system

MECHANICALLY DRIVEN COMPRESSORS can be built for practically any suction and discharge pressure that materials of construction can stand, and the effects of varying suction or discharge pressures are well known. Steam-jet thermocompressors, however, have a relatively limited range of variation in each of three associated pressures—suction, discharge and motive steam.

As previously shown (POWER, Jan 1945, p 74) system pressure can vary within reasonable limits and delivered steam flow can range from near-zero to more than nominal capacity if the flow-pressure relation remains above the break point or if unstable operation at reduced efficiency can be tolerated. The usual method of flow-control, however, provides for throttling motive steam.

Fig. 6 illustrates effect of varying motive-steam pressure. On the right-hand chart, curves for motive-steam pressure cross the system-pressure line at break points where the thermocompressor operates unstably. Horizontal dash lines extend left to the capacity curve indicating the limit of operation for each motive-steam pressure. Dotted curves show resulting unstable capacity relation for the various motive-steam pressures, along which operation of the thermocompressor is practical but at reduced efficiency.

Partial Capacities

For example, if suction pressure is fixed at 25 psia and system pressure is to be held at 50 psia, motive steam must be throttled if less than design capacity is required. Suppose that a given thermocompressor is designed to deliver 50,000 lb per hr at 100 psia motive-steam pressure and that only 37,000 lb per hr are needed. Extending data of Fig. 2 (of part I), we find that four lb of motive steam are required under design conditions to entrain 1 lb of vapor; or, 40,000 lb per hr of motive steam plus 10,000 lb per hr of vapor make up the 50,000-lb-per-hr flow.

Throttling motive steam to 80% (80 psia) reduces motive-steam flow to 32,000 lb per hr (80%x40,000 lb per hr). Following the 80% motive-steam pressure curve down to 25 psia (100%) suction pressure, entrained steam flow is found to be 50% of design, or 5000 lb per hr, making a total of the required 37,000 lb per hr.

With constant discharge pressure of 50 psia required, the thermocompressor operates unstably as shown by intersection of 100% suction pressure and 100% system pressure lines being to right of and below the 80% motive-steam pressure curve on the right-hand chart.

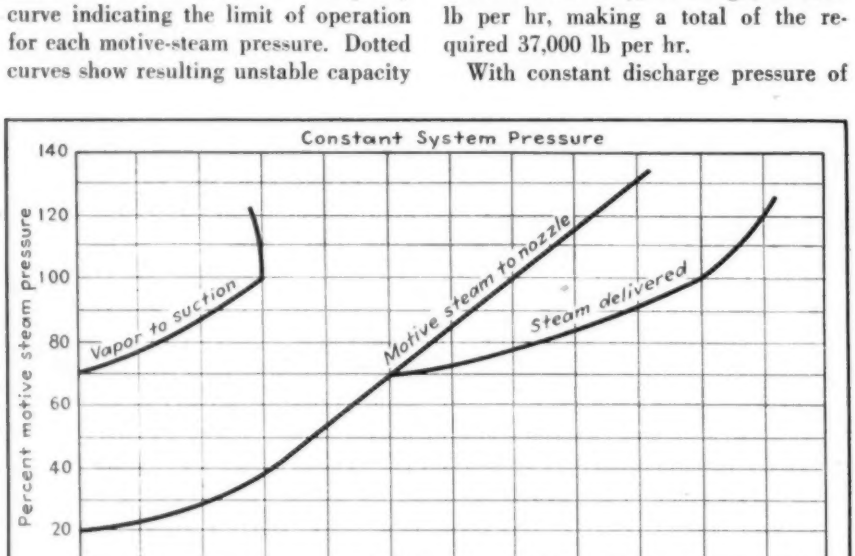


Fig. 6—Typical effect of varying motive-steam pressure on thermocompressor performance. Chart at left gives suction-pressure capacity relation; curves at right indicate range of safe maximum discharge pressures for various motive pressures

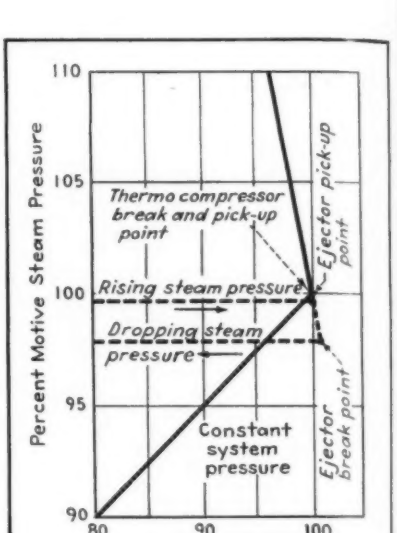


Fig. 7—For constant suction and discharge conditions capacity falls off only slightly for increased, and greatly for reduced, motive-steam pressure

Throttling motive steam is the typical method of obtaining variable capacity when fixed suction and discharge conditions apply. It must be remembered that the motive-steam quantity varies directly with *absolute* motive-steam pressure. Total weight of steam discharged from the thermocompressor is therefore affected by both the change in entrainment and the weight of motive steam when throttle control is used.

The stable capacity curve shown in Fig. 6 is the same as Fig. 5 of Part I of this article. Actually a slight difference should be made to account for a capacity increase accompanying reduced motive pressure until the break point is reached. Fig. 7 illustrates what happens in greater detail. In this plot suction and discharge pressures are assumed constant with capacity and motive-steam pressure varying. As mo-

ntermediate-Pressure Processes—II

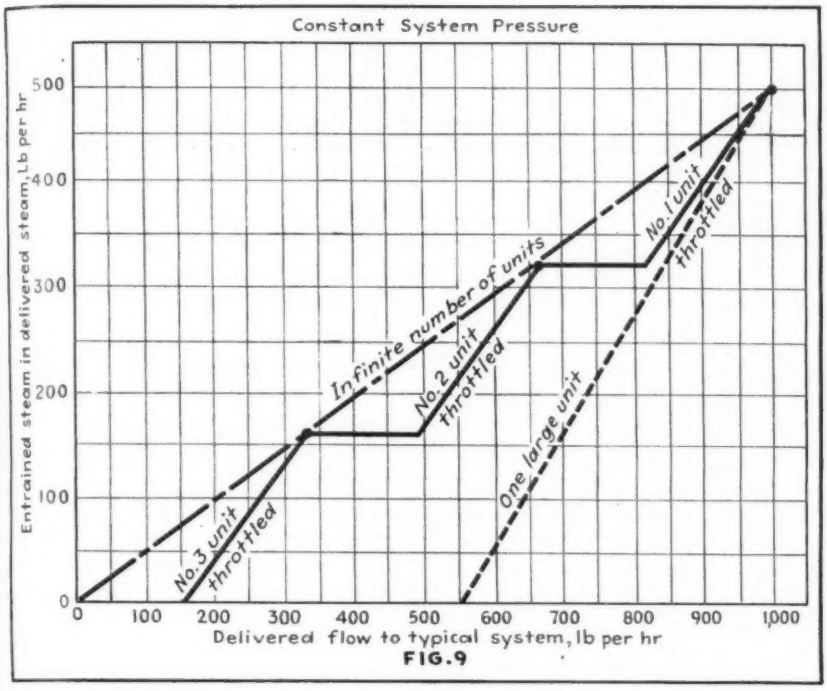


Fig. 9—Advantage of several small units in parallel is indicated by greater amounts of entrained steam at partial flows as compared with single larger jet

tive-steam pressure increases above the break point capacity falls off only slightly. When motive-steam pressure is reduced below the break-point value, however, capacity falls off rapidly. The effect below the break point can be readily determined by cross-plotting Fig. 6 using a constant suction pressure.

Fig. 7 illustrates the essential difference between a conventional steam-jet ejector and a steam-jet thermocompressor. The ejector characteristic below the break point is marked by an extremely rapid fall-off in capacity resulting in an almost horizontal line. If ejector motive-steam pressure is increased, the pickup point occurs at a pressure higher than the break point. In a thermocompressor the break and pickup points are usually so close together as to be indistinguishable.

Usual operating problems involve consideration of both Fig. 5 and Fig. 6. It is possible to combine these into a single chart but the resulting confusion of lines is difficult to interpret and use. It is more logical to plot both relations (1) varying system pressure and (2) varying motive-steam pressure on separate sheets for each type and size of thermocompressor under consideration.

A modified form of Fig. 7 plotted in Fig. 8 is of considerable assistance in planning actual operating procedure. Assume constant suction and system pressure conditions and plot motive-steam pressure against total flow of steam discharged. In Fig. 8 values are shown in percent of design conditions. Total steam delivered is the sum of flow to suction and motive steam. Low steam demands are met by throttling motive-steam. Fig. 8 shows that no entrainment occurs below about 70% motive-steam pressure corresponding to about 50% of design flow to the discharge system, and it is necessary to install a check valve at the suction to prevent reverse flow under such conditions.

Amount Entrained

As demand increases it is met by an increased flow of motive steam produced by increased pressure at the nozzle. As motive-stream pressure increases, entrainment occurs and discharge includes both motive and entrained steam. Efficiency increases until full design conditions are reached. Beyond the 100% design point, efficiency again falls off as indicated by Fig. 7.

Throttling control can be accomplished automatically by employing the Nelson system (patent 1,875,574) which provides for regulating backpressure by automatic throttling of the motive steam. Unless conditions are constant or vary quite slowly, some form of automatic control is necessary to maintain efficiency. One usual operating complaint can be traced directly to failure to note changing conditions and reset motive-pressure regulating device to compensate.

To meet widely varying loads with good efficiency, two or more thermo-

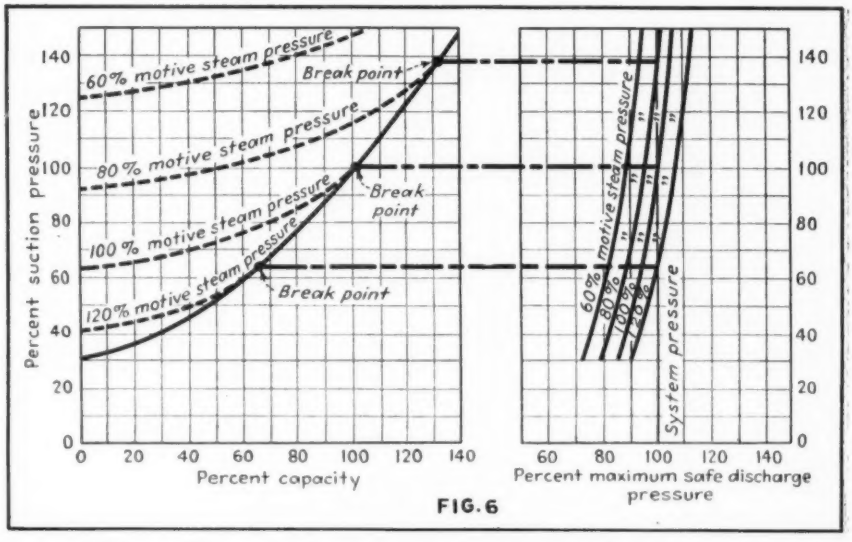


Fig. 8—For a typical case where discharge flow is controlled by throttling motive steam, curve shows the relation of entrained, motive and delivered steam

compressors should be installed in parallel so that individual units can operate somewhere near design conditions. Fig. 9 illustrates a condition where 50% of the total delivered steam is entrained at the design point. The advantage of multiple small units over a single large unit is clearly shown by increased percentages of entrained steam at partial loads.

Data for this type of curve are obtained from plots similar to Fig. 8. Design conditions for this case assume one lb of motive steam compresses one lb of entrained vapor to the desired discharge pressure. Suction and discharge pressures are assumed constant as for Fig. 8. For a single large unit, variable discharge demand is met by throttling motive steam, and the design entrainment ratio of 1:1 can not be maintained at partial loads. Entrainment falls to zero at about 55% of design flow.

Three equal-capacity thermocompressors in parallel, however, produce the irregular solid curve shown, breaks occurring as each cuts in. As demand for steam decreases below maximum only one of the three units is throttled, the other two continuing at full flow and efficiency. The throttled unit entrains less and less suction vapor as demand decreases until its entire flow is made up of throttled motive steam, accounting for the horizontal segment of the curve. Further decrease in steam requirement calls for shutting down of the first unit entirely and throttling of the second jet and so on.

The curve indicates that considerably more entrained steam is used by three parallel units at all partial loads than would be the case with a single large thermocompressor. Since entrained steam at lower pressure is of relatively low value compared to throttled steam from a higher pressure level, every additional lb of low-pressure steam used represents a direct money saving.

If an infinite number of units were operated in parallel and step controlled (the limiting condition for increased number of units) the assumed entrainment ratio of 1:1 would be maintained at all flows. A line representing this best possible performance has been drawn on the chart of Fig. 9.

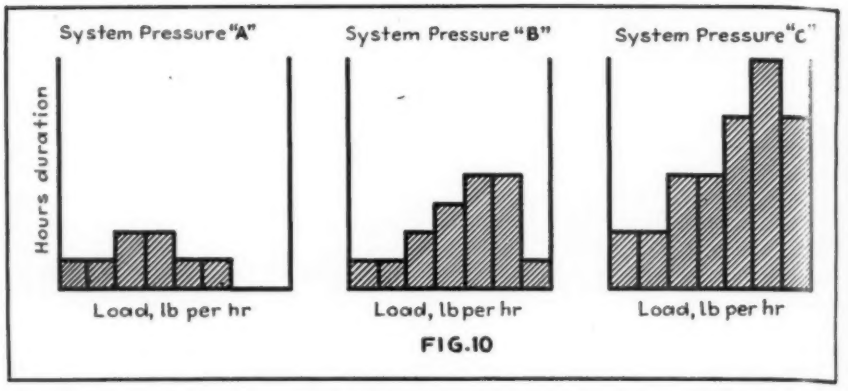


Fig. 10—Hourly demand plot of typical load at three different system pressures for determining best economy and proper arrangement for the best efficiency

The number of units to be installed in parallel and whether or not they should be of equal capacities can only be determined by a system demand analysis. The chart of Fig. 10 shows cumulated hourly demands for a typical installation requiring three different system pressures at various times. Since the ratio of entrained to delivered steam changes appreciably with varying system pressure (see Fig. 5 and 6), an investigation of each system-pressure requirement of appreciable duration is well worth while. By using the necessary number of curves similar to Fig. 8 and 9 and by referring to a chart like Fig. 10 for the actual case, proper arrangement of units can be secured for most practical efficiency.

Cost Studies

If in addition cost of steam at various pressures is known and a capital investment charge can be assigned, the most economical selection can be derived in the conventional manner. Admittedly this suggested data is often difficult to obtain but the savings made possible by proper selection of equipment are sufficient to fully justify time and expense necessary to compile the information.

In general it is advantageous to use duplicate units in parallel as less testing is required of the manufacturer and fewer spare parts need be carried on hand by the user. It is distinctly undesirable to use such a large number of jets that the size becomes very small as the greater effect of machining imperfections (on thermocompressors for less

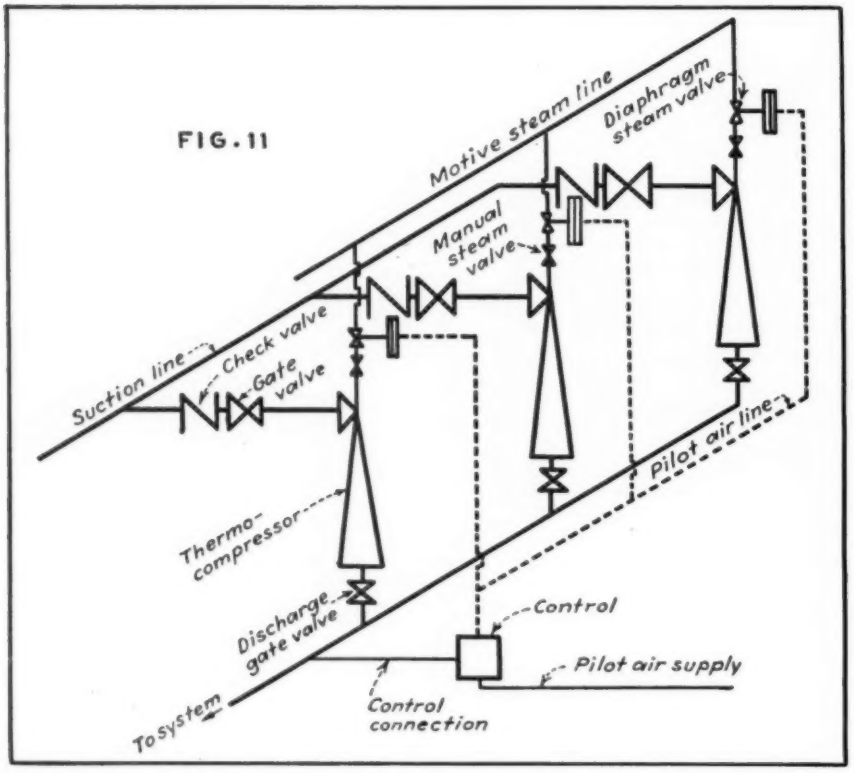


Fig. 11—Typical arrangement of three units in parallel with automatic control by spring-loaded diaphragm valves, pilot air line and regulator-controller

than 400 lb per hr discharged) results in lower efficiency than for the larger sizes.

Fig. 11 shows in single line the diagrammatic arrangement of three thermocompressors in parallel with Nelson automatic control. Steam valves of spring-loaded diaphragm type open and close at different pilot-air line pressure. Gate valves in suction and discharge of each unit, as well as in the motive-steam line, provide for cleaning and repair of any unit without affecting the others.

A check valve, to prevent backflow at low loads, is located ahead of the gate valve in the suction line. This allows use of a check valve larger than the thermocompressor suction to reduce pressure drop across the valve. Diameter of thermocompressor opening is chosen to give a maximum velocity about 200 ft per sec. Usually the design calculations indicate that the discharge should be larger than the suction, in which case it is standard practice to use a larger suction opening than the required minimum to conform to the discharge diameter. Unit sizes are then expressed by the size of suction and discharge connections. Also, to reduce pressure losses, reducers are often connected to suction and discharge where they connect to larger diameter mains.

While the most convenient pilot fluid for operation of the diaphragm valves is usually air, either water or steam can be used if local conditions favor one or the other fluid. If more than three units are installed in parallel, however, it is recommended that more than one pilot control be used.

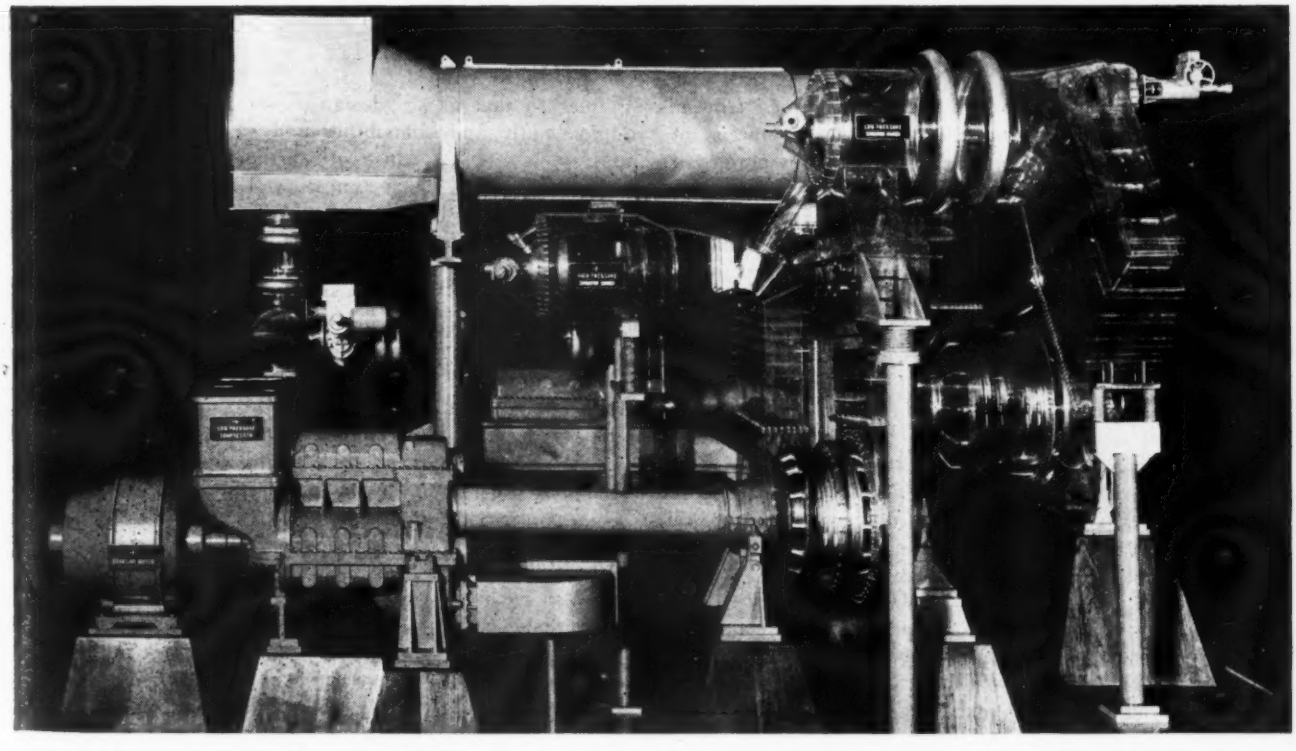
Applications

Steam-jet thermocompressors are comparatively light in weight and can be readily installed well above floor level. They are quiet in operation, require little attention and can thus be installed anywhere in the plant. Valve stems are the only moving parts and thus the assembly can be mounted outdoors if protected against freezing. Trained operators are not required and, if automatic control is employed, only periodic supervision is necessary. Maintenance and repair are limited to periodic inspection, lubricating the valves and replacement of worn parts.

The fact that discharge steam is oil free is of great importance for certain process applications. For other special cases, such as highly corrosive vapors, special corrosion-resistant materials not practical for mechanical compressor construction can be utilized. It is also possible to install thermocompressors in series to obtain higher compression but the resulting mechanical efficiency is poor and generally a mechanical compressor will prove more economical.

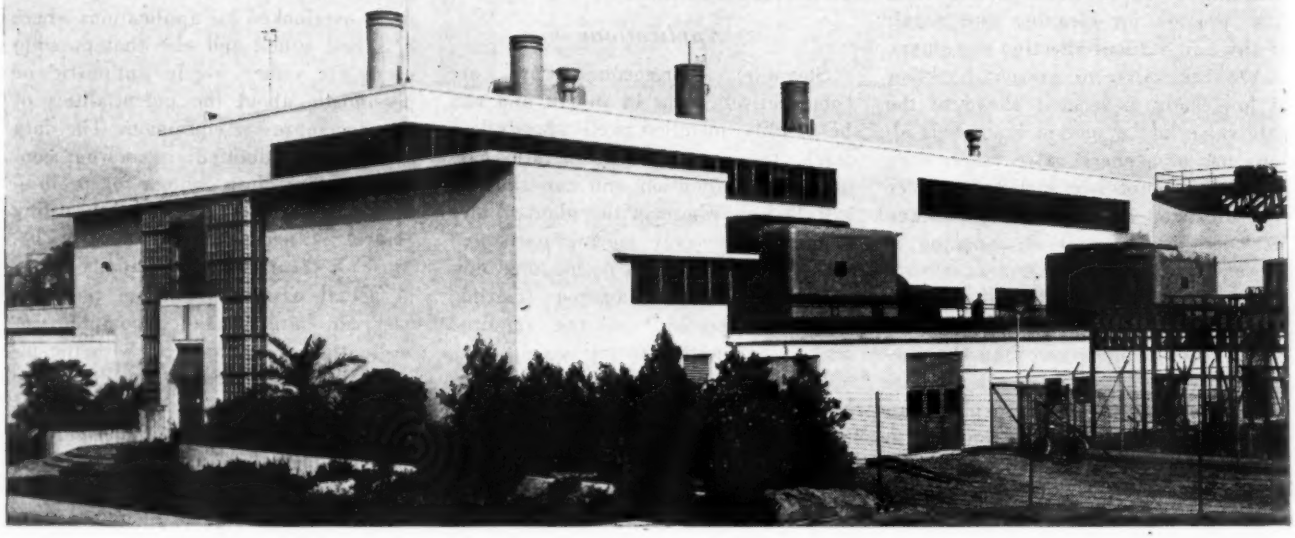
It has been our experience that the thermocompressor has often been entirely overlooked for applications where it is best suited and also that possible users are either overly optimistic or pessimistic about the potentialities of thermocompressor equipment. The data of Fig. 2 is admittedly somewhat conservative but close enough for preliminary investigation. Data on throttling control is necessarily illustrative because of the complex variations found in actual cases. While the potential user can hardly make a complete investigation of his problem with the information given here, he can determine whether the thermocompressor should be considered or not and then call on the manufacturers for detailed analysis of necessary basic data applying to his particular conditions if such investigation seems warranted.

Model of Gas-Turbine Ship-Propulsion Unit



Quarter-scale model gas-turbine propulsion unit built by the Elliott Co for the U. S. Navy reveals some hitherto unpublished construction details. Transparent material makes tracing the operating cycle easy and clear. The actual gas turbine, four times the model (6x5x4 ft) size turned over in the Elliott Jeannette shops early in November, 1944.

Operation of Burbank Cooling Towers



Ultramodern semi-outdoor steam plant in the heart of southern California's new industrial development was designed as standby but serves local demands close to 90% load factor. A report on cooling-tower experience by E J Strickland, Pacific Coast editor of POWER

► THE 20,000-KW STEAM PLANT of Public Service dept, City of Burbank, Calif., is one of the newer electric generating plants of the country, the first of its two 10,000-kw turbine-generator units having been installed in 1941 and the second, virtually a duplicate, in July, 1943. Operation of this plant, as well as its design and construction, is of interest because it reflects the manner in which a generating station has been able to meet war needs far in excess of those originally contemplated.

Fast-expanding aircraft factories of the neighborhood required not only expansion of the plant in 1943 but also much greater kwhr output than planned. Early in the war period it became apparent that the amount of power available to the city from Boulder Dam and from other generating sources of the Southwest Pacific power pool (POWER, Dec, 1943) would be quite inadequate to meet the demands of the airplane builders and other vital needs of the city. Moreover, energy from these sources is delivered for the most part over long transmission lines so that a local source of supplemental and standby power is essential.

To pick up load quickly in event of line failure, and thus operate effectively as standby, the plant is designed to hold steam pressure in the boilers, when not in full operation, 100 psi above that required for the turbines. This provides accumulation of steam for draw-down while boilers are being brought to full steaming rate, which takes about three minutes. The three boilers, about 120,000-lb-per-hr capacity each, and other facilities are interconnected to provide maximum flexibility.

Connected With Pool

Switching arrangements also are such that frequency regulation can be accomplished by either of the turbine governors or by transmission interconnections. Under these conditions 625-psi and 825-F plant operating conditions gave best balance between efficiency and plant cost.

In layout and architecture the plant is designed for maximum simplicity, flexibility and ease of operation. Because of wartime restrictions on construction as well as to reduce plant investment, the installation is of semi-outdoor type with boilers and accessories housed but generator units outside on the deck that serves as roof for the lower part of the building.

Designed and constructed as a supplemental and standby source of power, this plant has become the main source of energy for the local area, meeting loads considerably higher than had been anticipated. Ordinarily it now supplies more than 70% of the power distributed locally and is now regularly run at a load factor close to 90%. Operation under these conditions has developed interesting experience particularly as to operation of the cooling towers and water-treatment system.

Each of the two main turbines is served by an 8000-sq-ft condenser which derives its circulating water from a 10,000-gpm cooling tower. Towers are Marley horizontal, double-flow induced-

draft type, built in six cells, each an independent portion of the entire tower. Air is induced through the cells by six 12-ft diameter fans exhausting vertically from the roof of the tower.

This factor of vertical exhaust was an important factor in selection of cooling-tower type because the plant is located on a principal thoroughfare adjacent to a residential district. Drift of water blown from the tower by action of fans and wind is thereby practically eliminated. Positive control of the cooling function is also a prime requisite, and the appearance has been made to harmonize with the modern outlines of the main buildings.

Tower Layout

Air is drawn into the towers horizontally from both sides and passes over horizontal battens that fill the interior spaces to the induced-draft fans overhead. Heated water from the condenser flows into overhead basins, two above each cell of the tower, and is distributed through nozzles in the basin floor uniformly over the horizontal area of the cell. Intimate intermingling of air and water provides maximum cooling effect. Towers are designed to cool the water 16 degrees from 94 F to 78 F with a 65-F wet-bulb temperature, easily attained in actual operation.

Originally, plans called for use of partially softened water for makeup, about 200 gpm for each tower at full load. For this, the first unit was equipped with a sodium-zeolite unit of 150-gpm capacity to soften evaporator makeup as well as part of the cooling-tower supply.

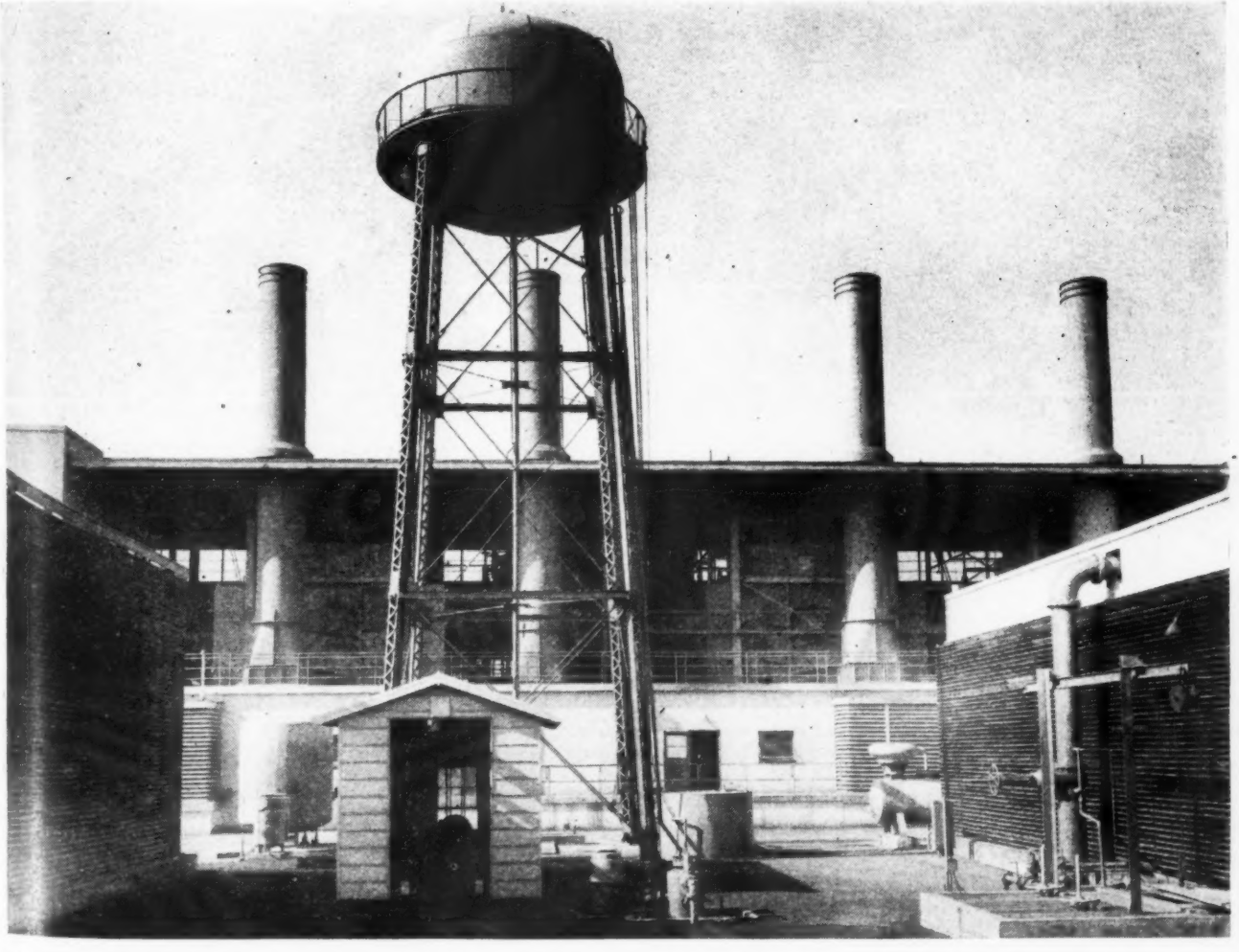
However, because of water conditions and heavy loads, it has been found desirable to soften all cooling-tower makeup. For the second unit, 400 gpm of softener capacity is included.

As shown in the diagram, water for the cooling towers is taken from a deep-well on the plant grounds, or, alternately, from the city mains. Water entering the plant from either source passes through the softeners and is stored in an elevated (50 ft) tank from which it flows by gravity into the cooling system as required. A float valve in the catch basin under the cooling-tower structure regulates makeup quantity.

Arrangement of circulating-water pumps varies slightly between the two units. The second installation has two pumps for alternate or parallel operation as required. One 10,500-gpm and one 6500-gpm capacity pump provide for variation in load on the main unit. At full load of 10,500 gpm, the pumping head is only about 56 ft, an important advantage of this type cooling tower.

Chlorination

Water supply contains algae. Slime growth within the cooling tower would quickly impair efficiency if not controlled. Also, conditions within the condensers are conducive to slime formation. For algae control, water in the cooling circuit is treated with 20 lb of chlorine per day from a one-ton cylinder



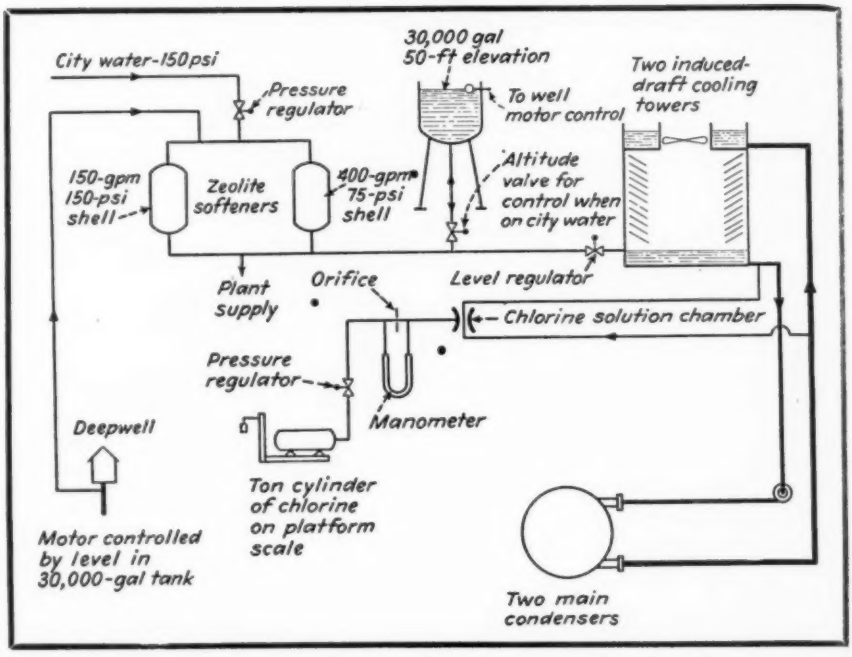
Storage tank for softened water stands between two tower units over chlorinating equipment in foreground. Note semi-open construction of boilerhouse in background. High-load-factor operation and use of well water call for fully softened makeup

mounted on a platform scale. Chlorine gas flows through a pressure regulator and mixing arrangement at each of the towers. Equipment consists of a manometer and valve through which chlorine is fed into a small water stream which carries it in solution to the sump at the foot of each tower at the intake of the circulating-water pumps.

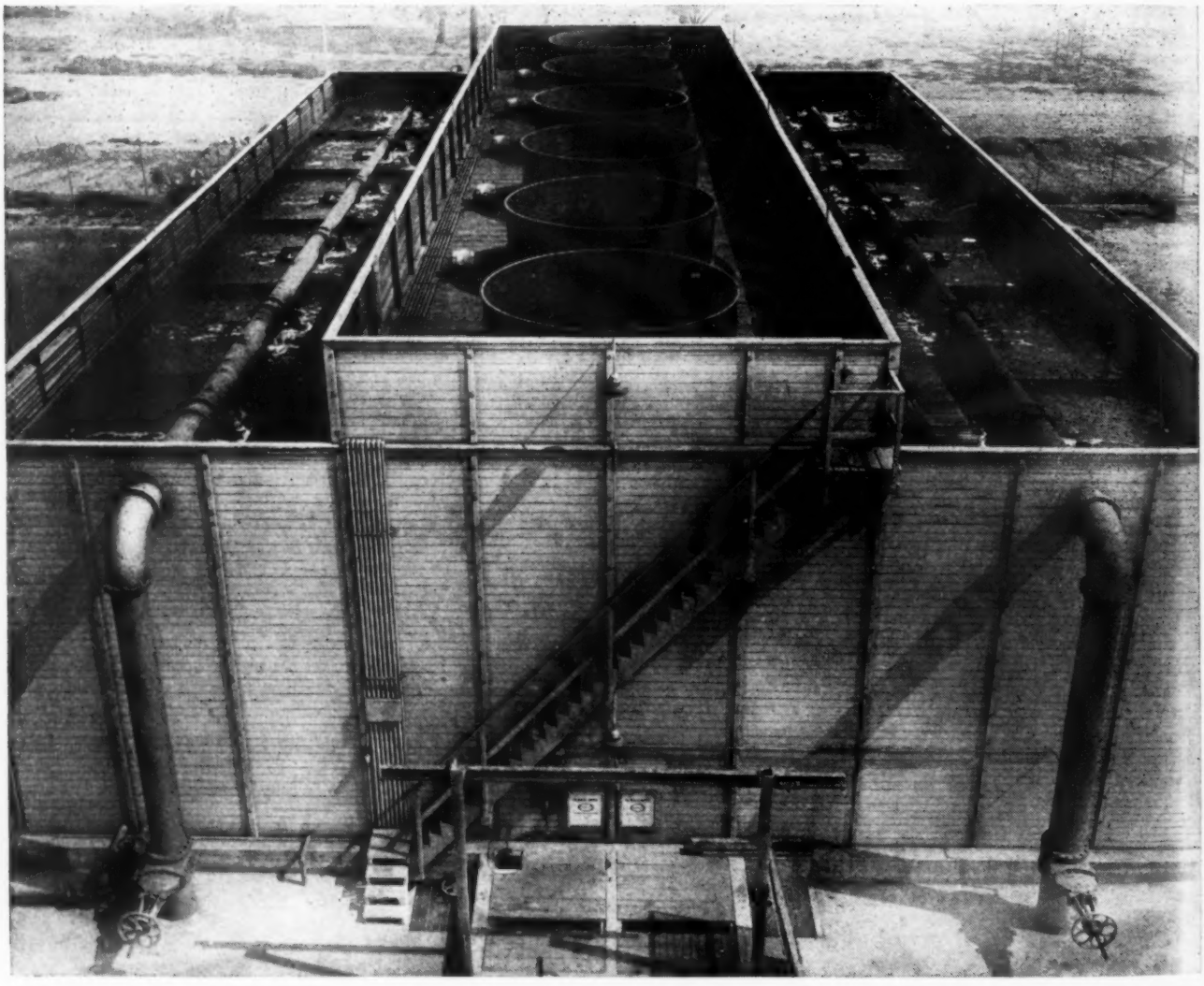
Added Treatment

In addition to chlorination, the water is also treated with a phosphate compound (Nalco 918) for control of scale and a chromate compound (Nalco 32) to inhibit corrosion. By blowdown, water in the system is held to a chloride concentration ratio, with respect to the makeup, of 6.0 to 6.5. Circulating water pH ranges from 9.0 to 9.3.

Maintenance expense on the cooling towers has been minor. It is expected to be even less as the effect of various improvements in water-treatment procedure is fully realized.



Flow diagram for water system. About 10,000 gpm circulates through each cooling tower. Chlorine feed is about 20 lb per day to each tower in four 2-hr periods



Looking down from the plant roof into the water-spreading chambers of double-flow side-inlet induced-draft cooling tower. This and a similar unit serve two condensers of about 8000 sq ft each holding 78 F with a 65-F wet-bulb air temperature

ISOMETRICS

FOR POWER ENGINEERS

BY *Phil Swain*

The engineer's ideas can never be fully effective unless he makes them clear to the nontechnical men whose cooperation he must enlist, from top industrial executives through skilled and unskilled mechanics to laborers. Many of these, including some who won't admit it, can't read blueprints. The only answer is a picture drawing in which a single view gives any observer instantly what the trained eye is supposed to deduce from a study of standard orthographic plans and elevations.

Three common systems are perspective, isometric and "cabinet." Perspective, Fig. 2, is true and pleasing, but the converging lines and variable scale make it hard to draw and interpret. Isometric and cabinet avoid these objections, yet clearly show the form of the object.

Cabinet, Fig. 3, draws the front, flat face of an object exactly like its true elevation (compare Fig. 1) — a great advantage sometimes. The fore-and-aft scale (along the slant lines) is compressed — a disadvantage.

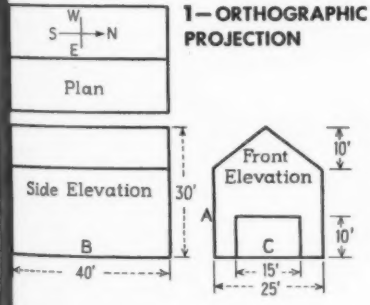
Isometric drawings of square-cornered objects show vertical lines as verticals and horizontal lines as 30-deg slopes. In these articles north is drawn 30 deg up to the right, and west 30 deg up to the left, as in Fig. 5 at left, although the conventions pictured at right in Fig. 5 are equally correct. Comparing Fig. 1 and 4, note that true-scale orthographic dimensions can be laid out along all three isometric directions. This fact favors isometric over cabinet for general engineering use.

Circles show as ellipses in isometric. With ellipse templates now on the market this is no great drawback. Note that the ellipses are alike on the three perpendicular faces of the cube, Fig. 5. All isometric ellipses have the same proportions.

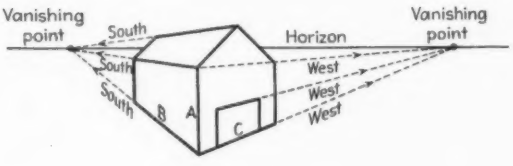
Isometrics may be drawn with T square and 30-deg triangle, but isometric ruled paper (see page 92) is often more convenient. Make practice sketches on tracing paper over grid on page 94.

This 8-page section gives interested engineers a good start in the easy and useful art of isometric sketching. Skill in this kind of picture-making saves time and improves power planning, construction and operation.

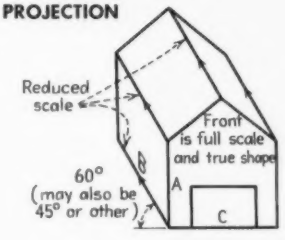
1—ORTHOGRAPHIC PROJECTION



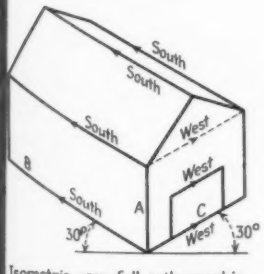
2—TRUE PERSPECTIVE
Scale varies all over drawing



3—CABINET PROJECTION

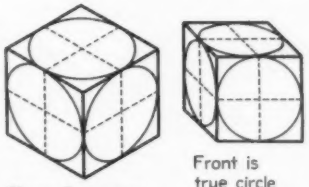


4—ISOMETRIC



Isometric uses full orthographic scale for verticals, east-west and north-south lines. Looks oversize, but compare actual measurements

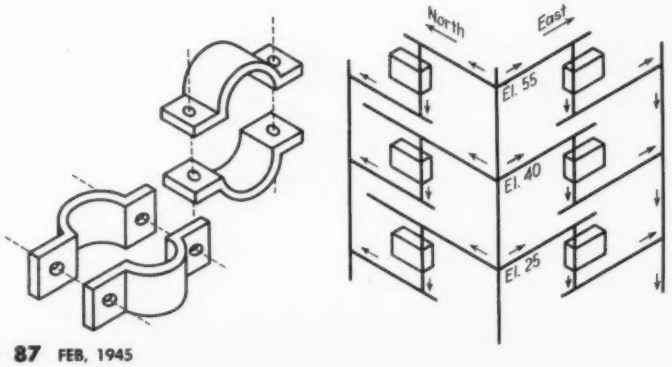
5—ONE-INCH CUBE



Three faces are 3 equal diamonds, and 3 circles are equal ellipses

Front is true circle in true square

6—SAMPLE ISOMETRICS



SQUARE-CORNERED OBJECTS

Consider a shoe box, packing case or sawed timber. All edge lines are straight and form three sets of four parallel lines, each set perpendicular to the other two. For drawing purposes, assume object is so turned that every line runs in one of three prime directions: vertical (*V*), north-south (*NS*) or east-west (*EW*).

All types of isometric sketching paper are ruled with three primary sets of lines representing the three prime directions. In all cases, vertical grid lines represent the vertical lines of the object.

Grid lines sloping up 30 deg one way represent one prime horizontal direction; those sloping up 30 deg the other way represent the prime horizontal direction 90 deg from the first. In these articles, *north* slopes up to the *right*, and *west* slopes up to the *left*, as shown in Fig. 2, left. Other possible conventions, Fig. 2, right, are equally acceptable.

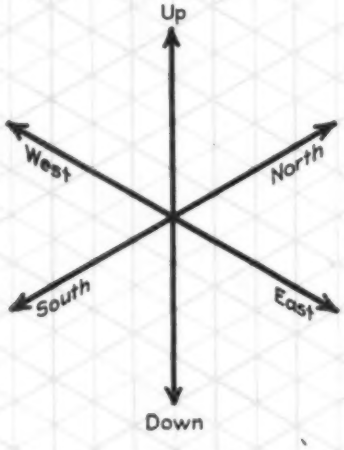
The isometric-paper background in this section is ruled with these three sets of parallel lines to form a grid of equilateral triangles, ¼ in. on a side. Note that isometrics always have the same scale in each of the three prime directions. In Fig. 3, each ¼-in. space is *one unit*.

Next look at any cube in Fig. 4. All edges are equal and equal to the edges of the actual cube. However, the square sides have been squeezed into identical diamonds, each the fusing of two equilateral triangles, base to base. Corner angles of this "picture" of a square measure 60 and 120 deg.

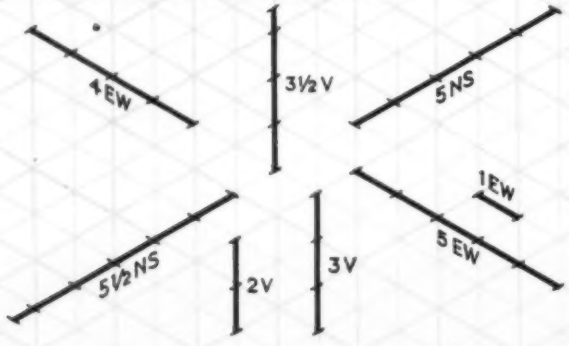
It now becomes easy to sketch a 1x2x3-ft box in various positions, taking each grid space as 1 ft. Practice drawing boxes of various dimensions on tracing paper clipped over the grid on page 94. Many engineering objects are rectangular, or made up of rec-

1—ISOMETRIC GRID TRIANGLES

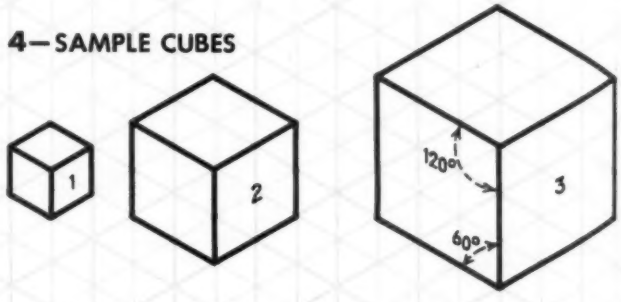
2—THE PRIME DIRECTIONS



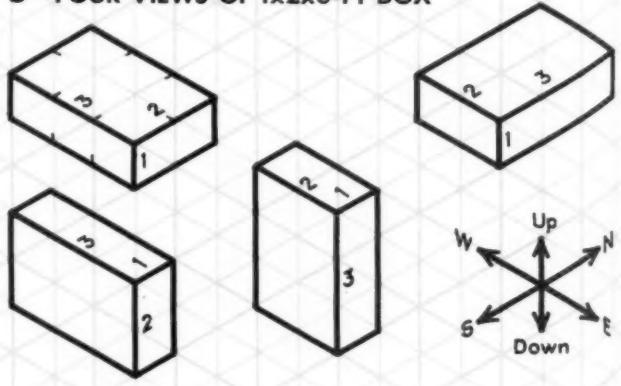
3—SAMPLE PRIME-DIRECTION LINES



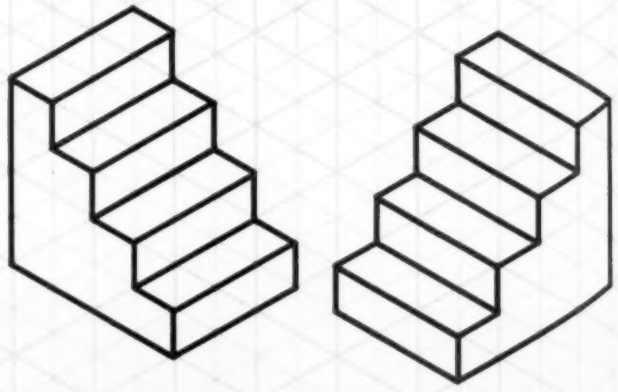
4—SAMPLE CUBES



5—FOUR VIEWS OF 1x2x3-FT BOX



6—TWO VIEWS OF STEPS

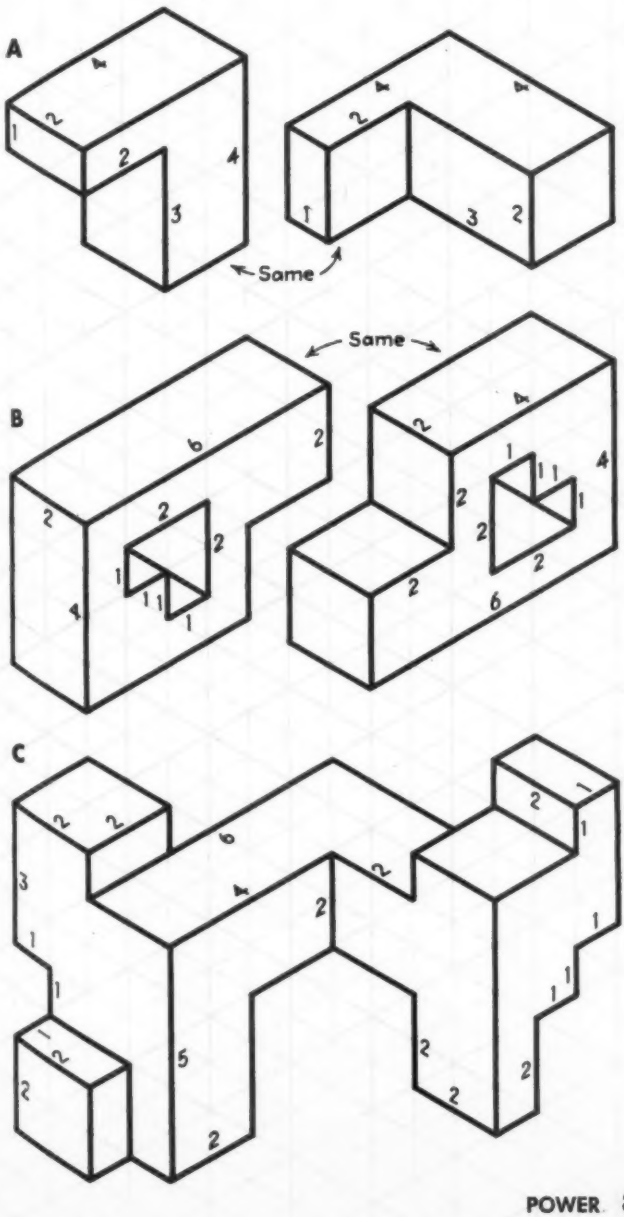


tangles, so edge lines run in prime directions. See Fig. 4 to 8 for handling of rectangular shapes.

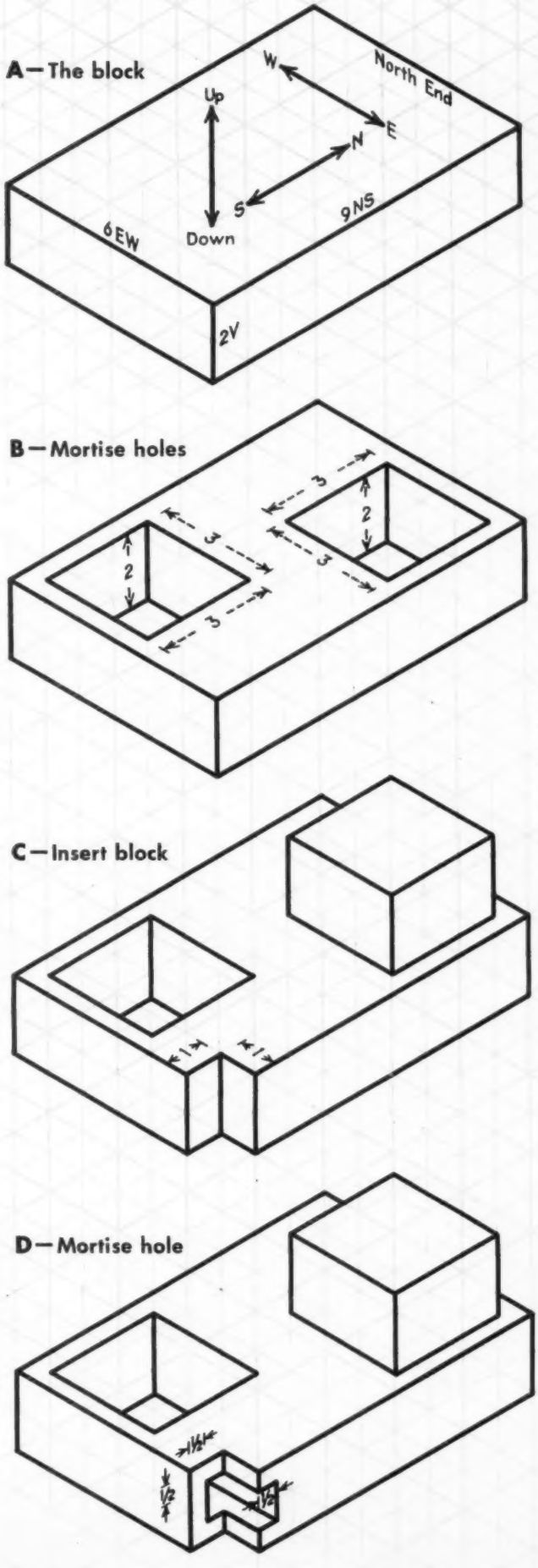
Study the two views of a flight of stairs and work out other views. Also sketch stairs of different shapes and dimensions in various views. Fig. 7 shows other square-edged shapes, simple and complex, all easily understood in isometric.

Fig. 8 shows step-by-step translation, into an isometric any mechanic could follow, of a block described as follows: (*A*) Start with block 9 in. *NS*, 6 in. *EW* and 2 in. *V*. (*B*) Mortise two vertical 3-in. square holes, one centering 2 in. from edges in northeast corner of block, the other centering 2 in. from edges in southwest corner. (*C*) Leave second hole empty. Fill first with square-section plug rising 2 in. above surface of block. Also cut a 1x1-in. vertical square notch out of southeast corner. (*D*) Mortise a square 1-in. hole through block on a horizontal center line 1 in. down from top surface, parallel with and 1 in. from south end of block.

7—SAMPLE BLOCK SHAPES



8—ISOMETRIC TO FIT DESCRIPTION (SEE TEXT)



STRAIGHT-LINE ISOMETRICS

So far we have considered objects having lines in the prime directions only — up-down, north-south, east-west. The next problem is to sketch objects whose edges are all straight lines, but with some of the lines not running in the prime directions.

The main lines of a building, a duct or a timber may be square, with odd-direction lines introduced by the slope of the roof, or by a slanted saw cut across the timber. The effect is the same when a square-sided ventilating duct or breeching is crossed by a damper or enters a larger duct at an angle.

In all such cases, the following rules will help place such odd-direction lines correctly:

RULE 1 — *Straight* lines in the object are *always* drawn *straight* in isometric.

RULE 2 — *Parallel* lines in the object are *always* drawn *parallel* in isometric.

RULE 3 — A saw cut in a vertical plane will make a vertical edge on *all* vertical surfaces.

RULE 4 — Conversely, if a saw cut leaves a vertical edge on *any* vertical surface, it will leave vertical edges on *all* vertical surfaces.

RULE 5 — All lines *vertical* in the object appear *vertical* in isometric.

RULE 6 — A *parallelogram* (four-sided figure with opposite sides parallel and equal) appears in isometric as another *parallelogram*.

RULE 7 — *Any* possible saw cut completely across a straight piece of rectangular cross section, say a timber, will produce a *parallelogram* in the sawed face. From Rule 6, this will appear in isometric as a *parallelogram* of different proportions.

RULE 8 — With *any* saw cut the sawed *edges* on two *parallel* faces of the piece will be *parallel* lines.

In Fig. 1, *A* exemplifies Rules 1, 2, 6, and 7; *B* illustrates Rules 1, 2, 3, 4, 5, and *C* Rules 1, 2, 6, 7, and 8.

In Fig. 2, the boiler bevel and the hut roof slopes are exactly equivalent to saw cuts in a block.

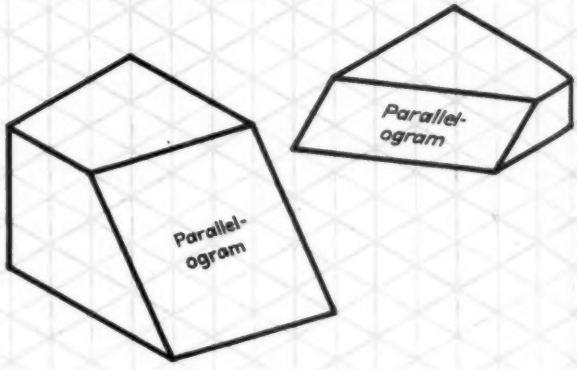
Hookups like Fig. 3 are easy if pipe distances and directions are kept in mind. Starting at *A*, the steam line runs 7½ ft up, 15 ft north, 15 north, 2½ north, 25 east, 30 down, and 12½ south, with a 5-ft. east branch, etc.

The key to laying out the offset hopper, Fig. 4, is the 6-ft vertical line that, according to assumed building instructions, places the center of the top lower square 6 ft directly below a point in the bottom of the upper rectangle 2 ft from its west side and 1 ft from its north end. Draw upper rectangles first, then lower rectangle. Then connect the two by the converging lines, here shown dotted.

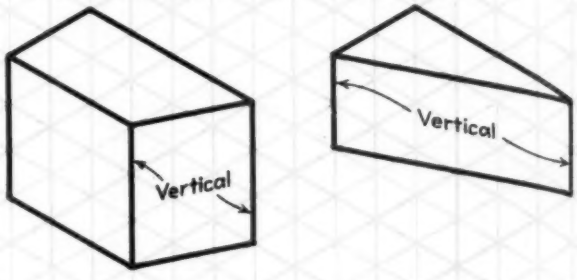
When other methods fail, any object may be drawn in isometric as shown for the building in Fig. 6. First draw a ground plan in isometric and on it mark points directly below important corners in the structure above. At each such floor point, put down the elevation above ground or floor of the upper point concerned. Then at each floor point erect a vertical of the indicated height. Connecting the tops of these verticals completes the building. Common-sense observation will generally show how to do the connecting. Any rear parts that are hidden by forward parts should be erased or left dotted.

1 — FLAT SAW CUTS ON PIECES OF RECTANGULAR SECTION, SUCH AS TIMBER

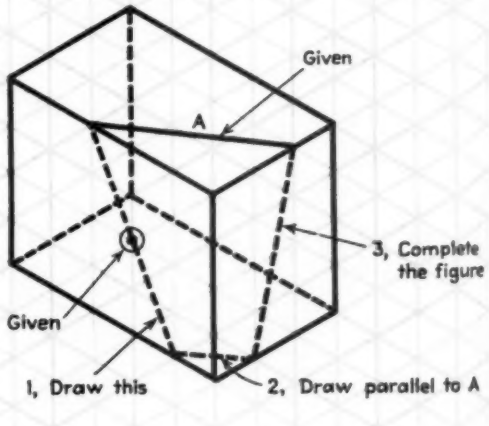
A — The cut is always a parallelogram (opposite sides equal and parallel)

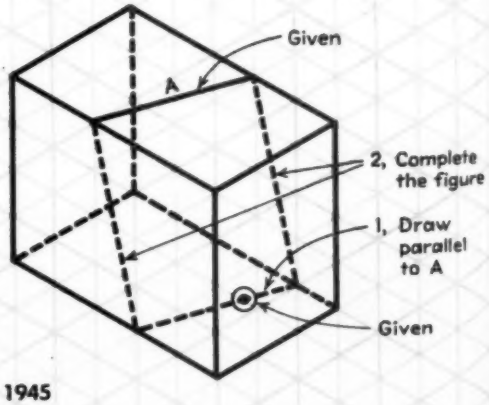


B — If cut is vertical, it will give vertical sawed edges on all vertical surfaces

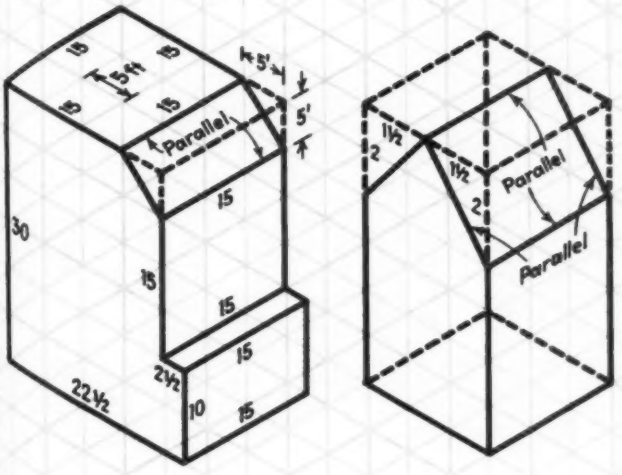


C — Given cut line on one side, and another point through which saw passes, draw complete cut

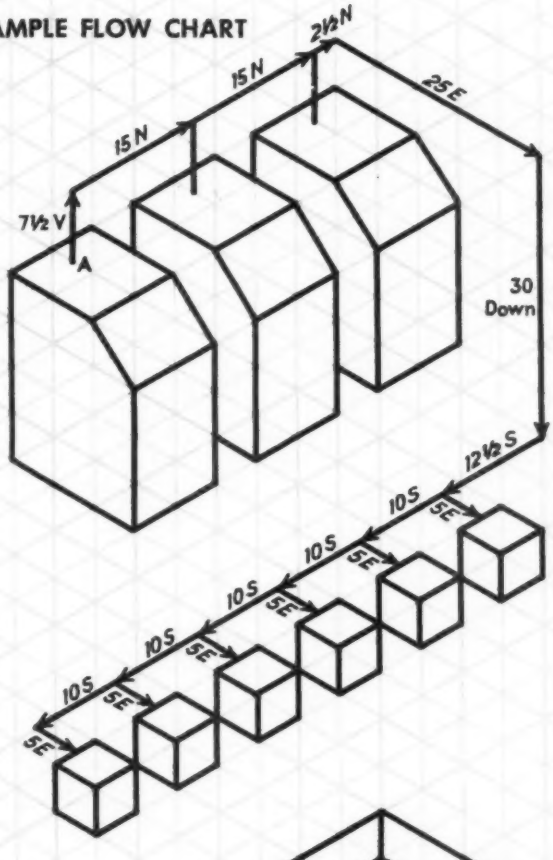




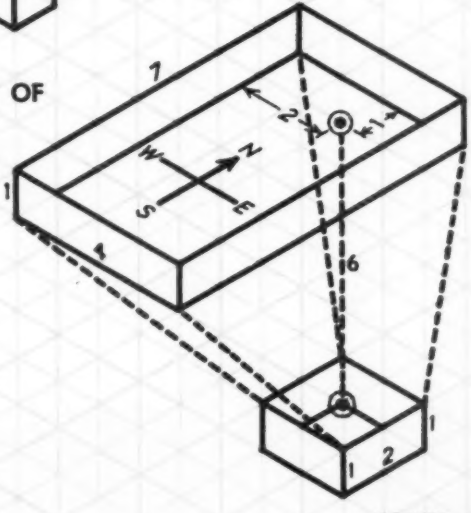
2—IDEAS OF FIG. 1 APPLIED TO SIMPLE BOILER AND HUT



3—SAMPLE FLOW CHART

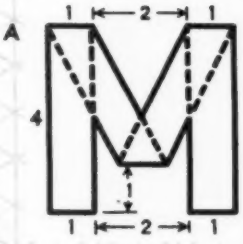


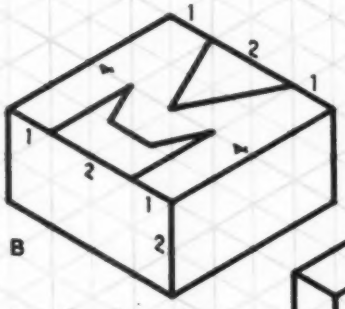
4—LAYOUT OF OFFSET HOPPER



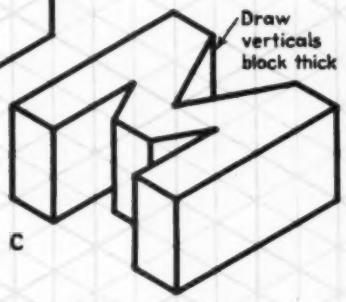
5—SKETCHING SCROLLSAW WORK

A—Draw outline to scale in orthographic



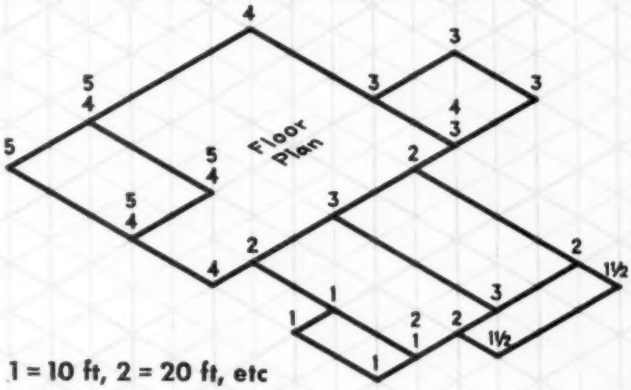


B—Sketch outline in isometric

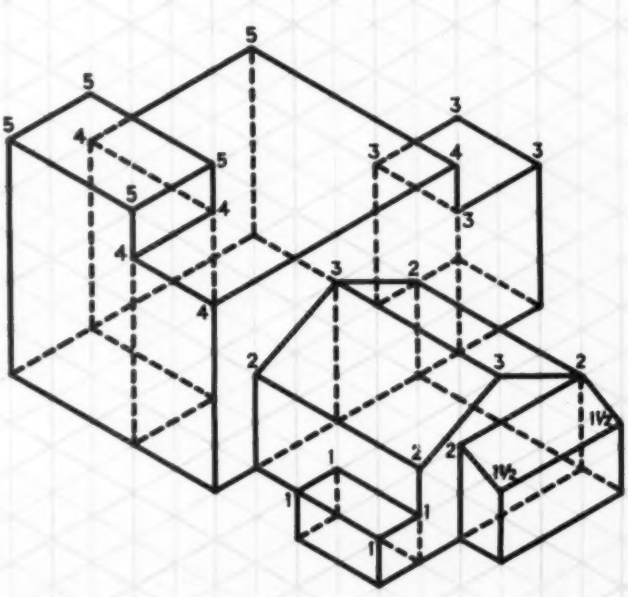


C—From outline drop verticals thickness of material. Connect the bottom ends

6—SKETCH BUILDING FROM ISOMETRIC FLOOR PLAN WITH CORRESPONDING OVERHEAD ELEVATIONS INDICATED



1 = 10 ft, 2 = 20 ft, etc



CIRCLES AND CURVES

Just as there are three prime directions (vertical, north-south and east-west) for lines in isometric, so there are three prime directions for planes or flat surfaces. These are: horizontal (level) surfaces, vertical surfaces running north-south and vertical surfaces running east-west.

In isometric drawings circles always appear as ellipses. If the circles are on prime surfaces, the ellipses have standard proportions, Fig. 2, and the dimensions charted in Fig. 3.

Thus the three circles filling the three visible square faces of the cube of Fig. 1 are drawn as three identical ellipses in three identical diamonds. That representing a circle on the horizontal (upper) face has its long axis horizontal, while long axes of ellipses on vertical faces incline 30 deg right for north-south and 30-deg left for east-west face.

To avoid tedious construction of ellipses, trace them from Fig. 4 or, better, use celluloid ellipse templates made specifically for isometric drawing.

To lay out any cylinder, first draw in isometric the square-ended box that would exactly enclose it. The ends will appear as ellipses in diamonds. Wheels, pulleys and shafts are drawn like the cylinders in Fig. 5, 6 and 7. In Fig. 7 dotted lines show how to find the true top and bottom center lines of round horizontal tanks for location of pipe outlets.

Fig. 8 shows how any irregular contour on a flat surface (here the upper end of a turbine blade) is plotted first in true plan on a grid of squares, then transferred, point by point, to a corresponding isometric diamond grid.

Notes on Paper and Templates

Various types of isometric drawing papers may be obtained at main and branch stores of Eugene Dietzgen Co, 218 East 23rd Street, New York, N. Y. and Keuffel & Esser Co, 127 Fulton Street, New York, N. Y. Here are comments on various Keuffel & Esser items:

359-28 LB — Isometric tracing paper, 11x16½ in., blue ink. Isometric spaces are exactly ¼ in. Double ruling with both orthographic and isometric lines adapts paper to many conditions but may confuse users not skilled in isometric technique.

342 C — Isometric drawing paper, 13x19 in., green ink. This also combines square and isometric ruling, but is less confusing than 359-28 LB because vertical lines cross slant lines only at slant-line intersections, which is not true of 359-28 LB. Only disadvantage is that unit spaces are a little less than an even ¼ in.

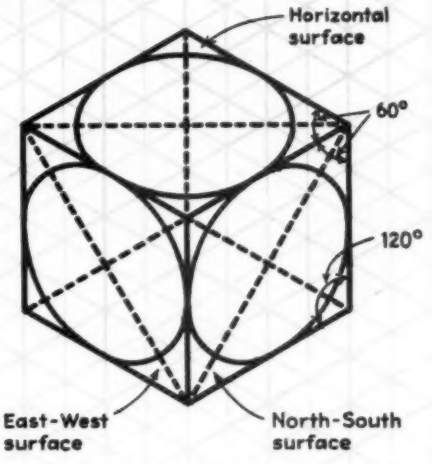
358-29 B — Isometric drawing paper, 8½x11, blue ink. This paper, which is punched for notebook use, contains isometric lines only and is easiest for the beginner to use if sheet size is suitable for his job. Spaces are exactly ¼ in.

1300 — This is a celluloid template for drawing isometric ellipses.

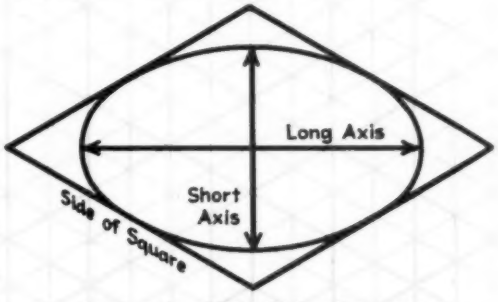
1310-1 — This is a complete isometric drawing kit, including among other items, the 1300 ellipse template and an instruction book.

To practice isometric sketching as explained in preceding pages, attach tracing paper to the grid on page 94, or get a reprint of this section and slide it under tracing paper on a drawing board.

1—CIRCLES ON FACES OF A CUBE APPEAR AS EQUAL ELLIPSES OF PROPORTIONS THAT ARE STANDARD FOR ALL SIZES

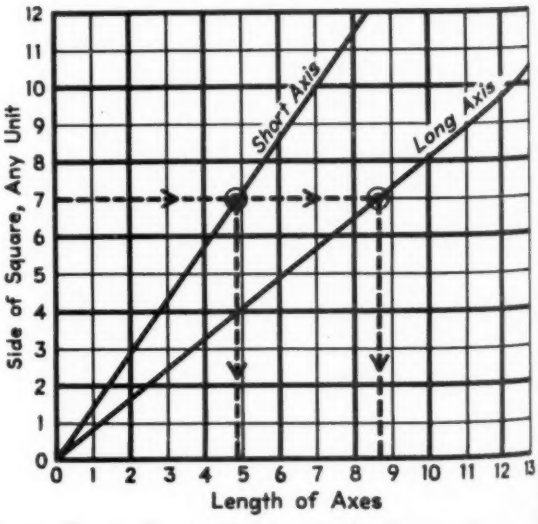


2—CIRCLE IN 1-IN. SQUARE APPEARS AS AN ELLIPSE 1.23 IN. LONG AND 0.7 IN. WIDE. THIS PROPORTION HOLDS FOR ALL SIZES



Long axis = 1.23 × Side of square
Short axis = 0.7 × Side of square

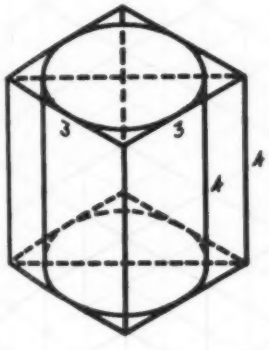
3—CHART GIVES DIMENSIONS OF ISOMETRIC ELLIPSES



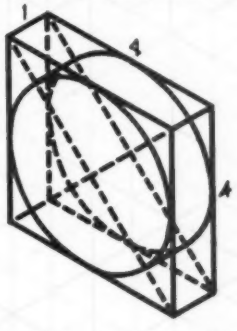
4—ISOMETRIC CIRCLES (ELLIPSES) FOR SQUARES OF 1, 2, 3, 4, 5, 6 AND 7 UNITS (EACH UNIT IS 1/4 IN.)

5—SAMPLE CYLINDERS WITH AXES IN THE THREE PRIME DIRECTIONS

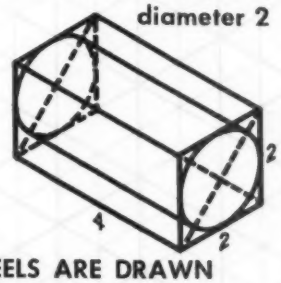
A—Vertical axis, height 4, diam 3

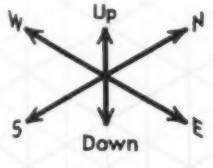


B—*NS* axis, length 1, diameter 4

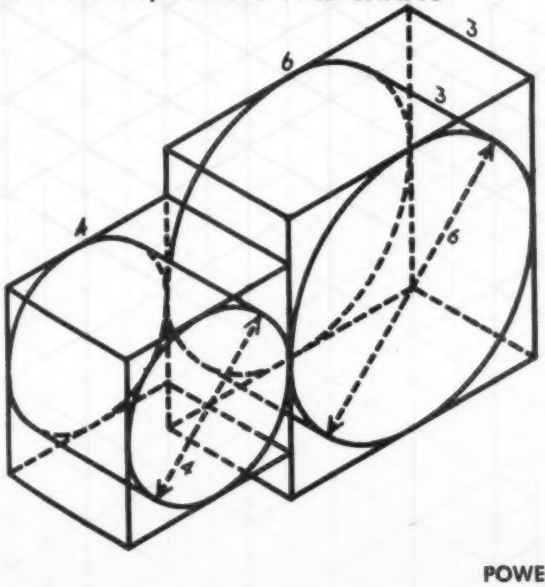


C—*EW* axis, length 4, diameter 2

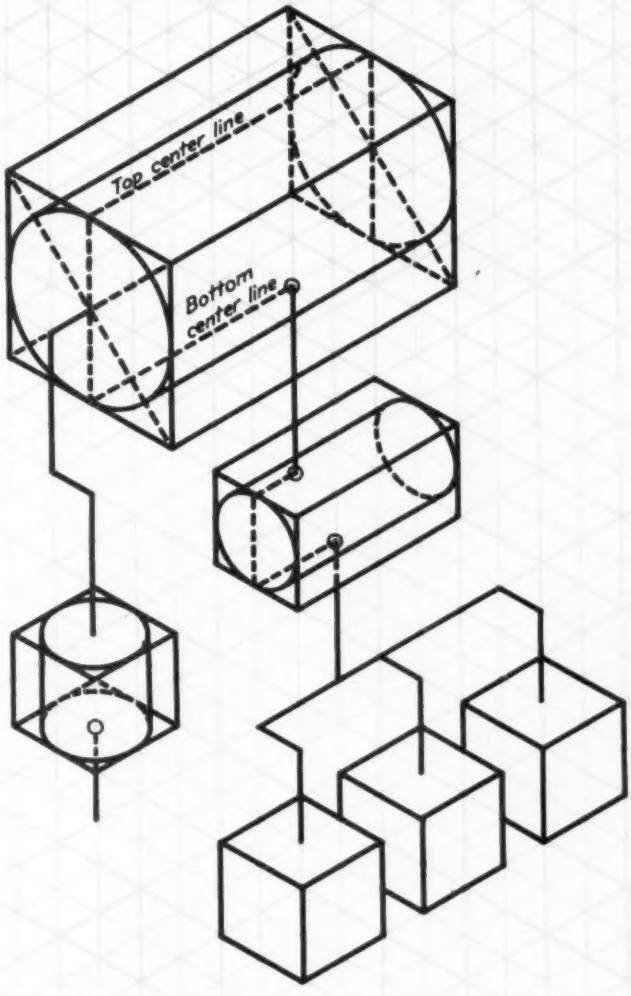




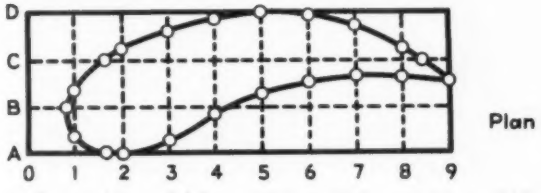
6—THESE FRICTION WHEELS ARE DRAWN LIKE TANKS, PULLEYS AND SHAFTS

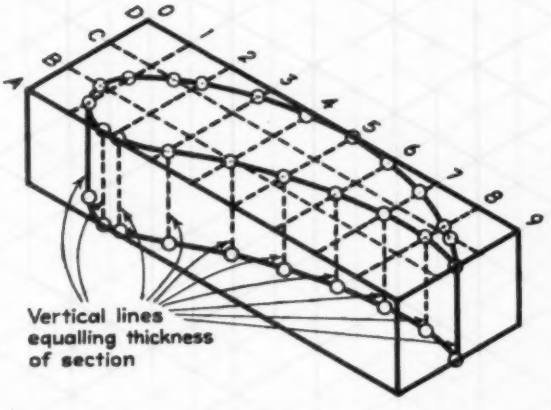


7—TANKS, ETC, IN POWER AND PROCESS HOOKUPS ARE EASY TO HANDLE



8—TURBINE-BLADE SECTION SHOWS HOW TO PLOT IRREGULAR SHAPES



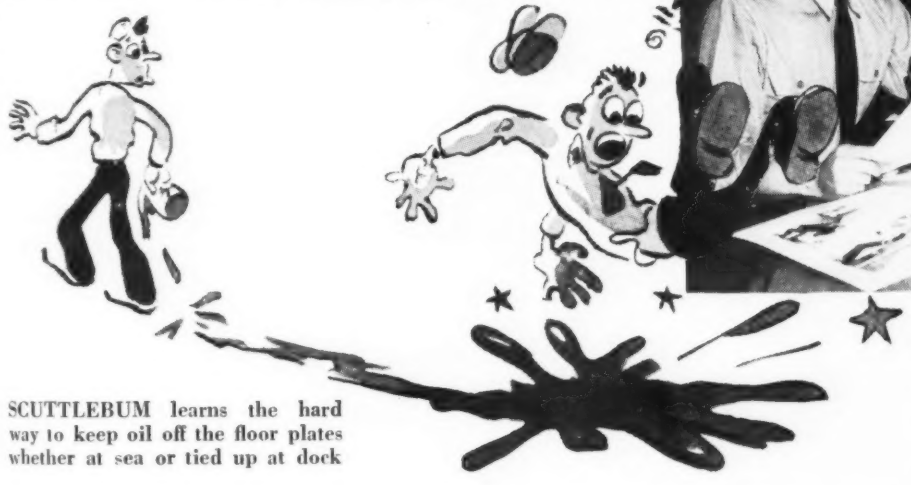


ISOMETRIC GRID FOR PRACTICE

(See note on page 92)

TEACHES THE NAVY

Cartoon character who forever does the wrong thing at the right time makes learning the ropes of ship operation both painless and quick. Walter Karig, Comdr, USNR, tells how



SCUTTLEBUM learns the hard way to keep oil off the floor plates whether at sea or tied up at dock

Lt (jg) W H Sullivan, father of SCUTTLEBUM, holds a bachelor's degree in art education from the Rhode Island School of Design. The job of creating and engineering the new-style manuals is his

SCUTTLEBUM, that "torrid-tar," who is forever doing the wrong thing at the right time, is fast becoming number one pin-up boy of the fleet. With a heart exceeded in size only by his gangling hands and feet, his bungling attempts to operate the complex machinery aboard ship are always good for a laugh. And his fumbling ineptness serves to point up the right way to do the job—valuable information for green hands, painlessly acquired.

SCUTTLEBUM has made good at putting across the do's and don'ts that govern shipboard operations. Boilers and turbines, for example, are mighty important pieces of equipment, as are the steam systems and their auxiliaries. It is essential that the men operating them know the tricks of the trade.

As the war made use of rapidly trained inexperienced men necessary, the casualty rate aboard ship skyrocketed. The Bureau of Ships realized that something new was needed in semitechnical manuals, something that would not only create interest and stimulate the desire to read, but also cut down operational casualties due to carelessness and inexperience. Thus was born a new group of manuals written in simple language and generously illustrated with cartoons, a "Pointer" series taking its style from the popular comic books. SCUTTLEBUM gets the feature billing and it's his job to tell the operator the things he needs to know.

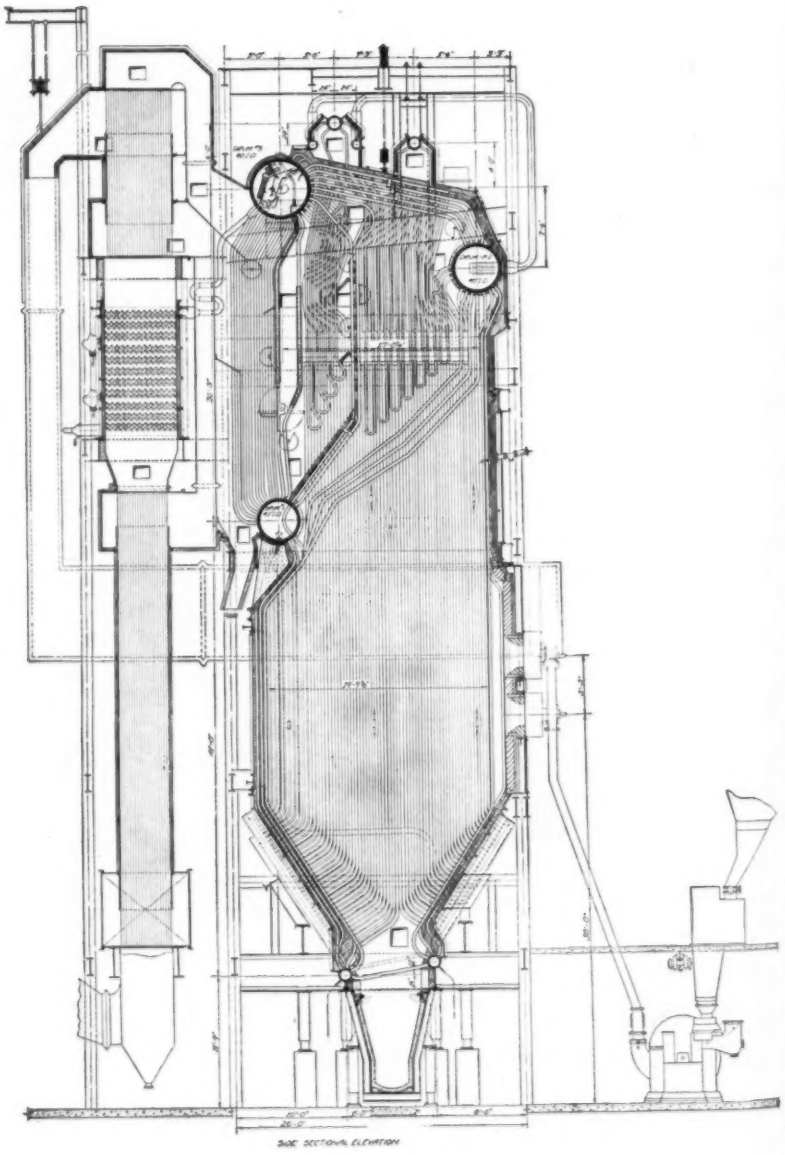
Objective of these manuals is to give pointers. They do not take the place of the Manual of Instructions, the manufacturers' instruction books and the check-off lists. They do, however, give a general picture of the business at hand in 25-cent words instead of dollar ones. It is BuShips answer to the complaint, "Geez, if they could only write stuff so that a guy who isn't an engineer could understand it." An innovation? Sure it is, but it's getting results and the men love it.

The "Pointer" series hits the important but easy-to-forget matters. The "funny books" don't carry the whole load but they are on hand for the idle moment, for use as a bridge between the more intensive training volumes and the young sailor. They meet a need regular texts can't fill.

Creating the new-style manuals is the job of Lt (jg) William H Sullivan, USNR, assigned to the training liaison section of the Bureau of Ships. A cartoonist by choice, and a writer by "order of the Navy," Sullivan visits Navy yards, manufacturers' plants, and naval vessels of all kinds to get the dope. He talks with everyone who has anything to do with the problem at hand. Trips to sea give him an oppor-

(*Continued on page* 98)

This performance is typical of Riley



300,000 lbs./hr. Riley Steam Generating Unit installed in large Pennsylvania Public Utility Plant.

Unit consists of Riley Boiler, Riley Superheater, Riley Water-cooled Furnace, Riley Continuous Tube Economizer, Riley Tubular Air Heater, Riley Steel Clad Setting and is fired by Riley Pulverizers and Burners

Design Pressure—975 lbs.

Total Steam Pressure—900°F.

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

It will pay you to visit modern Riley Installations

Public Utility Steam Generating Units

again actual performance exceeds guaranteed efficiency

Actual Efficiency – 89.77%
Guaranteed Efficiency–88.51%

A comparison of actual performance with guaranteed performance when operating at 277,481 pounds of steam per hour, 940 lbs. drum pressure, 896 lbs. superheater outlet pressure.

	Guaranteed	Actual
Total Steam Temperature	900°F.	900°F.
Temp. Water to Economizer	417°F.	453°F.
Temp. Water to Boiler	441°F.	487°F.
Temp. Gases Leaving Boiler	800°F.	800°F.
Temp. Gases Leaving Air Heater	304°F.	308°F.
Temp. Air Leaving Air Heater	580°F.	622°F.
Overall Efficiency	88.51%	89.77%

The majority of Riley steam generating units are operating at appreciably higher efficiencies and capacities than guaranteed. Riley, therefore, not only gives the purchaser his money's worth, but in case after case a significant bonus. On thirty-three recent tests, actual efficiencies of Riley Boiler units exceeded guaranteed efficiencies by an average of 1.576 points, representing thousands of dollars of additional fuel savings to Riley users—an extra dividend to those companies which purchase Riley Steam generating units.

Such outstanding performance has brought about a tremendous increase in the use of Riley Boilers by leading industrial and central station companies—a most significant swing to Riley. Complete satisfaction from existing Riley Units has resulted in large numbers of repeat orders—one company 9 different orders for 9 Riley Units; another 7 orders for 20 Riley Units; another 6 orders for 14 Riley Units; another 6 orders for 11 Riley units. Positive proof of the satisfactory results being obtained by users from Riley steam generating units.

In addition to the largest units, Riley also manufactures specially designed units of capacities down to 7500 pounds of steam per hour.

All of these well-known Companies have installed Riley Boilers

Houston Lighting & Power Co.
Pennsylvania Edison Co.
Carolina Power & Light Co.
Southern Ind. Gas & Electric Co.
Central Illinois Light Co.
Union Electric Co. of Missouri
Union Electric Co. of Illinois
Florida Power & Light Co.
Gulf Power Co.
Mississippi Power Co.
Iowa-Illinois Gas & Electric Co.
Interstate Power Co.
Otter Tail Power Co.
Central Ohio Light & Power Co.
City of Los Angeles, Calif.

INDUSTRIAL PLANTS

Curtiss-Wright Corp.
Dow Magnesium Co.
Carbide & Carbon Chem. Corp.
General Electric Corp.
Carnegie-Illinois Steel Corp.
American Brass Co.
Allis Chalmers Mfg. Co.
Winchester Repeating Arms Co.
Henry Disston & Sons Co.
Scovill Mfg. Co.
General Motors Corp.
Container Corp.
Norton Company
Masonite Corporation
Celanese Corp. of America
Parke Davis Co.
Kellogg Co.
Beechnut Packing Co.
Standard Oil Co. of New Jersey
Standard Oil Co. of Indiana
Standard Oil Co. of Louisiana
Standard Oil Co. of California
Shell Oil Co.
Western Cartridge Co.
Republic Steel Corp.
New York, New Haven & Hartford R.R.
Campbell Soup Co.
Publicker Commercial Alcohol Co.
Swift & Co.
Ruberoid Co.
Douglas Aircraft Co.
Bullard Co.
Revere Copper & Brass Co.
Mead Corporation
Pet Milk Co.
Forstmann Woolen Co.
American Cyanamid Co.
National Lead Co.
International Business Machines
Nicholson File Co.
Moore Steam Turbine Co.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

efore purchasing Boiler or Fuel Burning Equipment

SCUTTLEBUM TEACHES THE NAVY

(*Continued from page* 95)

A turbine takes on personality to illustrate a point: "Failure to drain accumulated water invites disaster when the warming-up process starts. It will also catch the turbine short which, as all know, is embarrassing and uncomfortable"

tunity to see equipment in action. Some of the best cartoon ideas come from perspiring enlisted men below deck and others from officers on freezing bridges. Final results clear through the various technical sections of the Bureau of Ships.

Sullivan places much emphasis on covers designed to stimulate interest. Pictures of SCUTTLEBUM giving a complacent boiler a hot-foot, frying eggs on a hot annd perspiring turbine, pouring cans of Navy beans into one end of a steam system and getting steaks out of the other, catch reader attention. Inside the covers, cartoons carry on right through. They show the bungling activities of SCUTTLEBUM and the resulting mishaps. SCUTTLEBUM is the man about ships who can be counted on to get things balled up. (MORAL: Don't be the SCUTTLEBUM of your ship.) The pictures arouse interest; the text sustains it by telling the story in lines such as:

"Failure to drain lines properly can have serious consequences—besides branding you as a squirrel bait on the hoof"

"Quick execution of orders is impossible if the Engine Room is converted into a commando course by a few careless screwballs who clutter up the joint with everything from jacking bars to spare rotors"

"Don't make punching bags out of gages just because they fail to register the reading you think they should"

"Letting steam enter the turbine with too high a water content is practically the same as backing a load of bricks into an electric fan."

Yes, SCUTTLEBUM has become the helper of the fleet. By having their "bull in the china shop" make the mistakes, the Bureau of Ships finds that men on the ships make fewer. Much fun as the lads get out of seeing his mistakes, no one wants to earn his nickname."

"Pointers on Boiler Operation" was the first of the series, followed by "Pointers on Turbine Operation." Then came "Pointers on Steam Systems and their Auxiliaries," with "Pointers on Shipboard Ventilation" and "Pointers on Damage Control" now well on the way.

The early issues have been distributed by thousands. Calls constantly come in for more copies. Letters of commendation on the job SCUTTLEBUM is doing for fleet operating personnel have come from commanding officers of ships, commandants of Naval Districts, the Marine Corps, large universities, engineering corporations.

Most prized by the author are the letters from the men doing the work—the water tenders, machinist mates and engineers. These are the men for whom the books were written and their comments show they fill the need.

In the near future, SCUTTLEBUM will go still farther in his rise to fame. He is destined to be the hero of a Bureau of Ships training film, "Scuttlebum Gets the Air." And so the Navy's prize misfit continues to make the mistakes that any hand could make. Working on the theory that we all get a kick out of laughing at the other fellow's mistakes, and that we remember the things that make us laugh, the Bureau of Ships uses this new form of training publication and finds that it pays dividends in lower accident rate. SCUTTLEBUM, the Navy's oversized gremlin, is doing his bit.

"Don't get the idea you are a mountain goat and use the lube-oil gage line as a step. It's been done before with broken lines resulting. And while we are speaking about mountain climbing let us touch upon another phase of athletics, namely, boxing. There are lots better places to pursue this sport other than in the engine room. Don't make punching bags out of gages just because they fail to register the reading you want"

REDEDICATION

An Obligation to Our Fighting Men

DURING the last few weeks we have been forcibly reminded that so long as we still are fighting either of our major foes, first claim upon the productive resources of the United States—its manpower, materials, utilities, and industrial facilities—must be the production and delivery of munitions and war supplies. All other claims are secondary. No responsible citizen would have it otherwise. For in this war even more is at stake than our existence as a Nation. We dare not forget that we are engaged in a struggle that challenges the fundamental values upon which our civilization has been built.

It is not easy to list the values that we are fighting to uphold. They have been clothed in a variety of shapes over the centuries. They will assume new forms in the years ahead. But they have an inner consistency that free men the world over can feel and recognize: the right of the commoner against the noble, the right of the individual against the state, the right of trial by jury, the right to vote, the right to an education, the right to freedom of speech and worship, the right to work in a sphere of one's own choosing, the dignity and the equality of the individual under the law—these are our cultural heritage, painfully won and often precariously held over the ages, always to be rewon, redefined and buttressed by each succeeding generation of men.

The preservation of this vital core of value, and its transmission to our sons and daughters depends upon our victory in this struggle. So those things which are essential to victory must come first. And since the production of war munitions in overwhelming volume and quality can hasten that victory and save countless lives of our fighting men, no effort that will contribute to this end should be regarded by us as a sacrifice.

☆ ☆ ☆

The present is no time for self-congratulation upon our achievements either in the theatres of battle or of production. The mounting casualty lists should suffice to curdle the savor of any such indulgence. The most that can be said in reasonable taste and good conscience is that performance in both fields is such as to warrant our firm confidence that we can carry to successful completion the tasks that remain to be done.

Nor is there profit in even observing, much less deploring, that the tasks ahead are more formidable than those which were defined for us a few short months ago. Then, all of us—military leaders, government officials, workers, and business men—were riding a crest of optimism as to an early end of the war in Europe and as to the character and dimension of the war against Japan. Already we had begun to turn anxiously toward the problems of reconversion which then seemed so near at hand. Schedules for war production, based upon the best available estimates of need, called for a 5 billion dollar reduction from 1944 performance, even though we might have to continue a two-theatre war, and for a 40 percent reduction in the event of an early victory in Europe.

Today, those forward estimates have been revised sharply upward. That is true both of the 1945 requirements to meet the needs of a two-theatre war, and of requirements for the Pacific war once the European phase is ended. For this upward revision four chief reasons are responsible:

1. European battle experience has shown markedly greater use of expendable munitions than was provided in the formulae upon which our original production schedules were calculated: the result has been a depletion of inventories on a scale that would become dangerous if allowed to continue.
2. Experience has also demonstrated the need for new types of weapons or increased complements of some existing types to match new enemy equipment or tactics.
3. A less easy optimism as to the early ending of the European war has given rise to a growing disinclination to gamble on the approximate date.
4. An increasing conviction prevails that the war against Japan may require ground-army operations on the Asiatic mainland on a scale greater than originally premised.

But if these changes in the fortunes and outlook of war have raised our estimates of military requirements, may not subsequent favorable changes in the military situation cause them again to be revised downward? It is entirely possible. But our military men have learned that they cannot safely discount what *might desirably happen* as something that *will happen.* Those working on the production front also must learn that lesson. Fortunately, the record shows that we have been able to maintain a war production almost equal to that of the rest of the world combined, even while we produced for civilian use on a scale that has been large even by our

own pre-war standards. So we have ample margin to whip whatever war job may be required of us. As now defined, the task will not be easy. But it *can* and *will* be done.

☆ ☆ ☆

What, then, is the production task with which we are charged? Our 1945 production for the two-theatre war now calls for the substantial maintenance of the over-all levels reached in the latter months of 1944. But there is a shift of emphasis. Almost half of the programs for specific equipment items are declining. A few are scheduled to hold level. About 45 percent are scheduled to rise sharply. That means that workers and facilities must be shifted to man the expanding programs. At the same time the armed services are calling for many more men than can be supplied from those who become newly eligible to the 18 year old age group. That means further drafts upon war workers. It means also replacements for them when they are taken from the expanding programs. Finally, events demand that we produce as much as possible of many items during the first half of 1945.

Our task, then, is one of intensified effort for the immediate future, with multiple readjustments at a stage when adjustments are hard to make. Materials for which demand was easing as pipe-lines were being drained in anticipation of falling schedules again are tight as the pipe-lines are being refilled to meet augmented requirements. Men, women, and facilities must be shifted from less essential to more essential tasks. What must be done will be done. But unless there is much voluntary accommodation, it will be necessary for us to suffer a formidable amount of governmental direction which none of us likes, many of us deeply resent, and all of us, when personally affected, volubly protest. The more we police ourselves, the less we shall be policed.

☆ ☆ ☆

Even after Germany has been defeated, we shall still face a far from light production requirement to continue the war against Japan. As currently defined this phase might require war expenditures at something like $70 billions a year, an over-all reduction of approximately 20 percent from the $89 billions spent in 1944. Reduction in munitions output would be somewhat greater, probably from 25 percent to 30 percent below 1944 levels. But it is important for us to acknowledge that the reduction is going to be substantially less than the 40 percent previously estimated.

Only a few months ago there were those who questioned sharply the possibility that we might need 60 percent of current munitions output to win the Japanese war. Now the judgment of the military is that 70 percent will be none too high.

Actually the latter level would represent an increase of little more than 50 percent above what now is being produced for the Pacific area. This, certainly, is a modest estimate when we reflect that we shall inevitably more than triple the Army forces assigned to that theatre.

Such a program probably would give us a current munitions supply from three to four times that produced by Japan, but it is believed that we shall need that much to compensate for the advantages derived by Japan from the fact that she will be fighting a defensive war, from the volume of her accumulated stores, from her prepared positions, her shorter lines of supply and transport, and from her large troop reserves, the bulk of which we have yet to meet in battle. Certainly our present 3 to 1 production edge over Germany does not appear to be excessive.

The more modest V-E Day cuts contemplated by the present plan will mean a less acute reconversion problem when they are made, but will leave a greater one to be met at the end of the war. They will mean probably a net increase of not more than 4 million workers available for civilian work during the transition period. Their orderly absorption should present no embarrassing problem. Indeed, we now are warned by Washington that war production following V-E Day may require the protection of considerably closer control than was contemplated under the 40 percent cuts previously expected.

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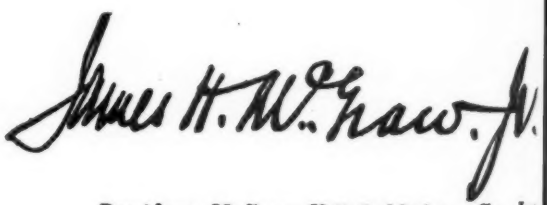
In short, we face for the immediate future a more difficult production job. It is made the more formidable by the fact that we had dulled the keen edge of our will to produce by our premature expectation of a reduction in requirements. Now we are told that the trend of war production for the immediate future is up, that it is unsafe to discount the date of victory in Europe, and that the amount of leeway for reconversion after the defeat of Germany is less than had been anticipated.

Accordingly, we must rededicate ourselves to the task of driving war production up. We must do without some of the things that we have enjoyed on the civilian front rather than demand more of those things; we have still to devote our abilities and energies first and foremost to the demands of war.

Whatever will assure and hasten victory must have first place in any statement of American policy.

Without victory, our aims, and the underlying values upon which they are based, will be extinguished, blotted out by the opposing aims and values proclaimed by our enemies.

The needs of our fighting men must be put first. For, unless we win the war, the National aims and policies of the United States will cease to have meaning in the world.



President, McGraw-Hill Publishing Co., Inc.

THIS IS THE 32ND OF A SERIES

Power Plant Travels 3000 Mph

Today's truth is stranger than the prewar dreams of science-fiction writers. Germany's V-2 rocket, propelled by an unusual automatically controlled power unit, starts straight up, rises 60 miles above the earth and lands 200 miles away five minutes after launching

▶ POWER ENGINEERS can't help but display intense interest in the unique mechanisms that propel Germany's V-2 rocket, hurtling its twelve tons' total weight through the stratosphere at 3000 miles per hour. Here is the first essentially complete description as released recently by the British Air Ministry.

German scientists have been investigating the possibilities of giant rockets for the past 20 years. It was, therefore, not difficult to turn these experiments in a warlike direction when need arose for a long-range weapon.

Although experiments were undoubtedly made with various-sized rockets, the standardized streamlined projectile is 46 ft long, 5½ ft in diameter. It has a sharply pointed nose and at rear four external stabilizing fins at right angles to each other. With fuel, it weighs about twelve tons.

The V-2 is much more complicated in design and manufacture than the flying robot bomb. It consists of the following main assemblies in a shell formed like an airplane fuselage:

Main Assemblies of V-2

1. Nose with 2000-lb explosive warhead
2. Compartment with control equipment
3. Two large aluminum fuel tanks, one holding about 7500 lb of alcohol and the other about 11,000 lb of liquid oxygen
4. Turbine and pump assembly with a gas generator to drive the turbine
5. Large combustion chamber and venturi into which the alcohol and liquid oxygen are forced through a series of jets
6. Two sets of control vanes. One set operates internally in the jet stream and the other externally on the edges of the four stabilizing fins

How V-2 Operates

The propulsive system of the V-2 falls into the rocket class as it derives all its power from the fuel it carries and does not depend on external air for combustion. It can therefore operate at extremely high altitudes where there is practically no air.

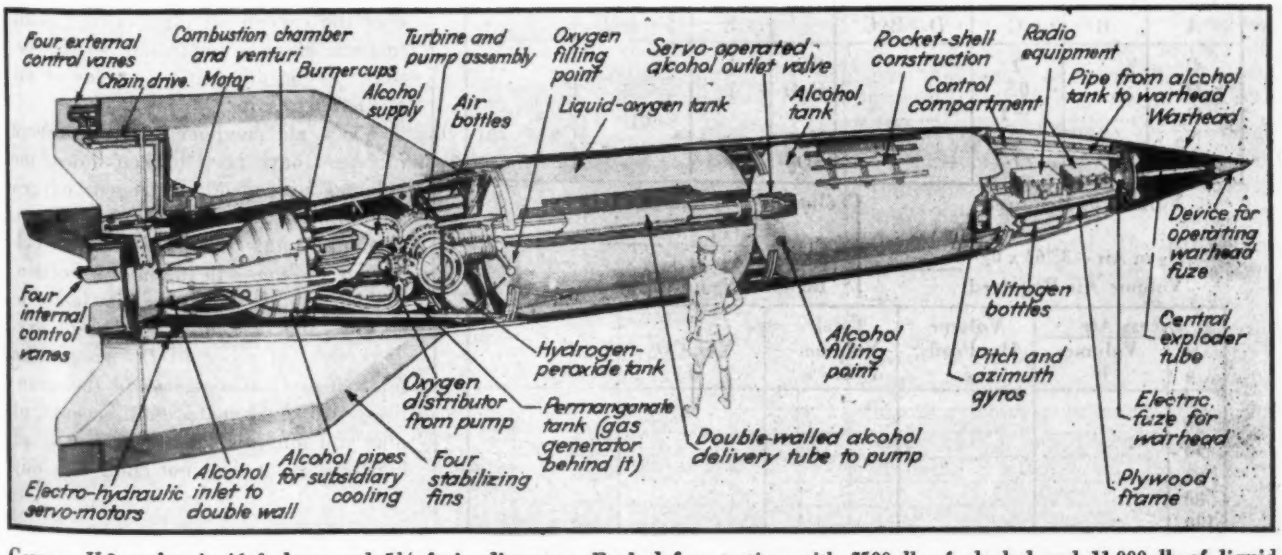
At present, launching and operation method is quite simple. The rocket stands in a vertical position on a concrete platform or hard surface. The turbine, driven by gas generated from concentrated hydrogen peroxide mixed with a calcium permanganate solution, powers pumps that force the liquid oxygen and alcohol into the combustion chamber. This mixture is then ignited by remote electrical control, and the rocket takes off.

Once ignited, the mixture of oxygen and alcohol continues to burn violently. Combustion products are forced out at high speed through the orifice in the rear end of the venturi as a jet of very hot gas. The energy so liberated creates a thrust of about 26 tons, which propels the rocket.

The V-2 starts by climbing vertically, but a gyroscope control within the projectile automatically moves the control vanes, causing the unit to curve away from the vertical toward the target. The mechanism is so arranged that the rocket points upwards at an angle of 45 deg about one minute after launching, and at this time the fuel supply is cut off either by remote radio control from the ground or by present automatic instruments in the rocket.

The point at which fuel cuts off determines range. If fuel burns for a long time, high speed and long range result. If it burns for a shorter time, speed is less and range correspondingly decreases. Since the rocket points upward at 45 deg when fuel cuts off and travels at about 3000 mph, it continues upward following the path that would be taken by a shell fired at this angle. There is little air resistance in the up-

(*Continued on page* 138)



German V-2 rocket is 46 ft long and 5½ ft in diameter. Fueled for starting with 7500 lb of alcohol and 11,000 lb of liquid oxygen, and armed with a 2000-lb warhead, it weighs 12 tons. Drawing shows principal power equipment and control units

Sure-Fire Forms For Combustion Calculations

2—GAS FUELS

Last month Glenn C Boyer, associate engineer, Burns & McDonnell Engineering Co, presented a combustion form for solid and liquid fuels. Here is his computing form for gas fuels with examples for natural and sewage gas. All the needed constants are supplied

▶ THE COMPUTING FORM for solid and liquid fuels (page 77, Jan POWER) makes it easy to figure theoretical air, theoretical CO_2 and the CO_2 percentages obtainable with various percentages of excess air.

This article presents and explains a similar form (Fig. 1) for gas fuels.

However there are certain differences. Fuel-gas analysis is normally by volume so computations with this form are in terms of volume throughout.

The form includes three tabulations. Of these the upper breaks down each constituent into its chemical elements.

The middle tabulation serves for calculating the volume of theoretical air and the theoretical percentage of CO_2. That at the bottom is used to compute the percentage of CO_2 for varying amounts of excess air.

Procedure: First step is to enter the gas analysis (given in percent by volume) in the top left column. If the percentage of the given constituent is 76.6, the entry will be 0.766.

Next multiply these entries by the given factors to get the volumes in the second, third and fourth columns. To make this and later steps clearer, follow through with Fig. 2 for a natural gas having (by volume) 93.33% methane, 0.25% ethylene, 0.45% carbon monoxide, 0.22% carbon dioxide, 0.18% hydrogen sulphide, 1.82% hydrogen, 0.35% oxygen and 3.40% nitrogen.

Following along the first line (Methane), note that the 0.9333 volumes of CH_4 (methane) break down into 0.9333 "volumes" of carbon and 1.8666 volumes of hydrogen. The carbon "volume" is, of course, fictitious because carbon does not gasify at room temperatures. However the carbon all eventually appears in some gaseous compound, so this fiction will not affect the accuracy of the computed results.

When all component parts, except nitrogen, have been broken down, the volumes of carbon, hydrogen, oxygen and sulphur are summarized as shown. Then the totals are transferred to column *B* (volume) in the middle section.

Each volume in *B*, times its factor in *C*, gives the theoretical volume of oxygen (O_2) set down in *D*. To get the total theoretical oxygen add the quantities in *D*, taking proper account of plus and minus values. Nitrogen is an inert gas, so it does not enter into this

1 Combustion Calculation Sheet — Gas Fuels

Type .....

Gas Analysis (% By Volume):

	Vol.	Carbon	Hydrogen	Oxygen	Sulphur
Methane CH_4	.....	x1 = ...	x2 = ...		
Ethane C_2H_6	.....	x2 = ...	x3 = ...		
Ethylene C_2H_4	.....	x2 = ...	x2 = ...		
Carbon Monoxide CO	.....	x1 = ...		x0.5 = ...	
Carbon Dioxide CO_2	.....	x1 = ...		x1 = ...	
Hydrogen Sulphide H_2S	.....		x1 = ...		x1 = ...
Hydrogen H_2	.....		x1 = ...		
Oxygen O_2	.....			x1 =	
Nitrogen N_2					

Element A	Volume B	Oxygen Determination Factor C	Oxygen Determination Volume O_2 D=BxC		Combustion Products Factor E	Combustion Products Wet F=BxE	Combustion Products Dry
C	.....	1	+.....	CO_2	1	.....	.....(1)
H_2	.....	0.5	+.....	H_2O	1	.....	
O_2	.....	−1	−.....				
N_2	.....			N_2	.....	*.....	*.....(2)
S		1	+	SO_2	1		(3)

Volume O_2 Required

N_2 in Air = 3.764 x O_2 = _____

Volume Air Required

Volume Dry Products (4)

% CO_2 = (1)/(4) = ——— =

* Includes N_2 in Air

Excess Air % a	Excess Air Volume b	Volume Dry Prods. c	Total Volume d=b+c	Vol. CO_2 (1)	% CO_2 (1)/d
0	.....	.....	.....	.....	.....
20	.....	.....	.....	.....	.....
40	.....	.....	.....	.....	.....
60	.....	.....	.....	.....	.....
80	.....	.....	.....	.....	.....
100	.....	.....	.....	.....	.....

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Fig. 1—Convenient form computes theoretical air, theoretical CO_2 and CO_2 for various percentages of excess air

calculation of the theoretical oxygen.

After the required volume of oxygen has been figured in this way, the nitrogen that must come with it in the air supplied is computed (3.764 × oxygen) and the two values are added to obtain the volume of air required for theoretically correct combustion. In Fig. 2 the nitrogen is 3.764 × 1.8846 = 7.09 cu ft. Theoretical air is 1.8846 + 7.09 = 8.9746 cu ft.

Next step is finding the combustion products. Multiplying the volumes in column *B* by the factors in *E* gives product volumes in *F*. Total nitrogen volume is the nitrogen in *B* plus that in the theoretical air. Dry combustion products in the right-hand column are the same as the entries in column *F* except that water is omitted.

The sum of (1), (2) and (3) is the volume of the dry products of combustion, item (4). Divide (1) by (4) to get the CO_2 percentage for the theoretically correct amount of air. Thus 0.945 ÷ 8.0708 gives 11.7% CO_2.

Fig. 2—This typical natural gas takes 8.97 volumes theoretical air, producing 8.07 volumes dry combustion products, with 11.7% theoretical CO_2

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② Combustion Calculation Sheet —Gas Fuels

Gas Analysis (% By Volume): Type *Natural Gas*

	Vol.	Carbon	Hydrogen	Oxygen	Sulphur
Methane CH_4	0.9333	x1 = .9333	x2 = 1.8666		
Ethane C_2H_6		x2 =	x3 =		
Ethylene C_2H_4	0.0025	x2 = .0050	x2 = .0050		
Carbon Monoxide CO	0.0045	x1 = .0045		x0.5 = .0023	
Carbon Dioxide CO_2	0.0022	x1 = .0022		x1 = .0022	
Hydrogen Sulphide H_2S	0.0018		x1 = .0018		x1 = .0018
Hydrogen H_2	0.0182		x1 = .0182		
Oxygen O_2	0.0035			x1 = .0035	
Nitrogen N_2	0.0340	0.9450	1.8916	0.0080	0.0018

Element A	Volume B	Oxygen Determination Factor C	Oxygen Determination Volume O_2 D=BxC		Combustion Products Factor E	Combustion Products Wet F=BxE	Combustion Products Dry
C	0.945	1	+ 0.945	CO_2	1	0.945	0.945 (1)
H_2	1.8916	0.5	+ 0.9458	H_2O	1	1.8916	
O_2	0.008	−1	− 0.008				
N_2	0.034			N_2	.....	* 7.124	*7.124 (2)
S	0.0018	1	+ 0.0018	SO_2	1	0.0018	0.0018 (3)

Volume O_2 Required 1.8846 | Volume Dry Products (4) 8.0708

N_2 in Air = 3.764 x O_2 = 7.09 | $\%\ CO_2 = \frac{(1)}{(4)} = \frac{0.945}{8.0708} = 11.7\%$

Volume Air Required 8.9746 | * Includes N_2 in Air

Excess Air % a	Volume b	Volume Dry Prods. c	Total Volume d=b+c	Vol. CO_2 (1)	% CO_2 (1)/d
0	0	8.07	8.07	0.945	11.7
20	1.79	8.07	9.86	0.945	9.59
40	3.58	8.07	11.65	0.945	8.11
60	5.38	8.07	13.45	0.945	7.03
80	7.18	8.07	15.25	0.945	6.2
100	8.97	8.07	17.04	0.945	5.55

Fig. 3—This typical sewage gas takes 7.27 volumes of theoretical air, producing 6.74 volumes dry combustion products with 13.54% theoretical CO_2

As was the case in last month's form for solid and liquid fuels, the final step is the calculation of the CO_2 percentages for various percentages of excess air, using the bottom section of the form. Each value in *b* is theoretical air (here 8.9746) multiplied by the indicated percentage of excess air in column *a*.

Next enter in column *c* the volume of dry products, item (4) above. Add the values in columns *b* and *c* and enter in *d*. In column (1) enter the volume of CO_2, item (1) above. The percentage of carbon dioxide (last column) is then column (1) divided by column *d*.

Fig. 3 shows similar combustion calculations for sewage gas.

This combustion form for fuel gas, like last month's for solid and liquid fuels, can be reproduced by mimeographing or other means.

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③ Combustion Calculation Sheet —Gas Fuels

Gas Analysis (% By Volume): Type *Sewage gas*

	Vol.	Carbon	Hydrogen	Oxygen	Sulphur
Methane CH_4	0.766	x1 = .766	x2 = 1.532		
Ethane C_2H_6		x2 =	x3 =		
Ethylene C_2H_4		x2 =	x2 =		
Carbon Monoxide CO		x1 =		x0.5 =	
Carbon Dioxide CO_2	0.147	x1 = .147		x1 = 0.147	
Hydrogen Sulphide H_2S			x1 =		x1 =
Hydrogen H_2			x1 =		
Oxygen O_2	0.005			x1 = 0.005	
Nitrogen N_2	0.082	0.913	1.532	0.152	

Element A	Volume B	Oxygen Determination Factor C	Oxygen Determination Volume O_2 D=BxC		Combustion Products Factor E	Combustion Products Wet F=BxE	Combustion Products Dry
C	0.913	1	+ 0.913	CO_2	1	0.913	0.913 (1)
H_2	1.532	0.5	+ 0.766	H_2O	1	1.532	
O_2	0.152	−1	− 0.152				
N_2	0.082			N_2	.....	* 5.830	*5.830 (2)
S	0	1	+ 0	SO_2	1	0	0 (3)

Volume O_2 Required 1.527 | Volume Dry Products (4) 6.743

N_2 in Air = 3.764 x O_2 = 5.748 | $\%\ CO_2 = \frac{(1)}{(4)} = \frac{0.913}{6.743} = 13.54\%$

Volume Air Required 7.275 | * Includes N_2 in Air

Excess Air % a	Volume b	Volume Dry Prods. c	Total Volume d=b+c	Vol. CO_2 (1)	% CO_2 (1)/d
0	0	6.743	6.743	0.913	13.54
20	1.455	6.743	8.198	0.913	11.14
40	2.910	6.743	9.653	0.913	9.46
60	4.365	6.743	11.108	0.913	8.22
80	5.820	6.743	12.563	0.913	7.27
100	7.275	6.743	14.018	0.913	6.51

Armature Insulation-Resistance Probe Ferrets Out Trouble Spots

How do you determine cause of low insulation in an armature? C Weil, Westinghouse insulation engineer, gives the answer by describing an insulation probe and telling how to use it

▶ CONDUCTIVE MATERIAL carried into a large dc machine by ventilating air and deposited on the winding surface frequently reduces the machine's insulation resistance. Thus periodic inspection and cleaning are necessary to prevent insulation failure. Cleaning time can, however, be materially reduced by a simple probing method that determines low-insulation-resistance areas beforehand.

Dc motor and generator armatures are generally ventilated through the armature coils. Cooling air drawn in at the armature's rear end passes radially between coils at front and rear ends of the winding, Fig. 1. This air circulation, which results from natural fan action of the armature coils and commutator risers, is sometimes aided by a blower mounted on the armature.

Reversed Ventilation

Quite often ventilation is reversed by a fan that draws air through the armature from the commutator risers to the rear. This method cools the armature but draws into it carbon dust worn off the brushes. This highly conductive material, together with dirt, moisture or oil in the ventilating air, is deposited on the insulation surfaces, making conditions worse than when the armature is ventilated in a forward direction.

Moisture or oil in the ventilating air not only causes dirt to adhere to insulation surfaces but makes it more conductive and difficult to remove. Acids and other chemicals in the air still further aggravate this condition. This accumulation of conductive dirt on insulation surfaces creates low-insulation-resistance paths from ground to commutator bars or to bare connections between armature coils and equalizers. Conditions eventually become so bad that the armature must be taken out of service and effort made to correct its insulation resistance either by thorough cleaning or by stripping and rewinding with new coils.

The armature is usually cleaned

(*Continued on page* 140)

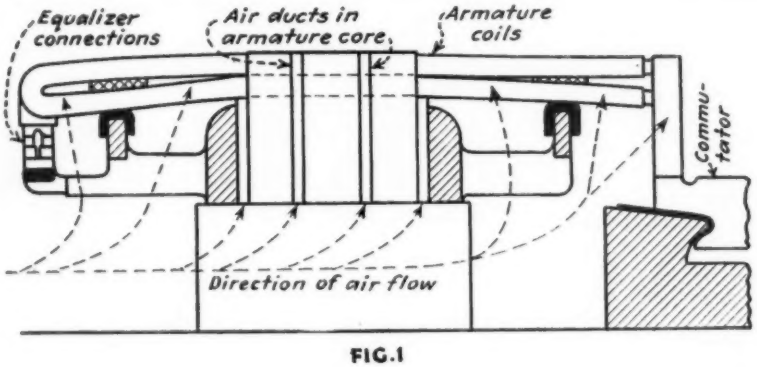


FIG.1

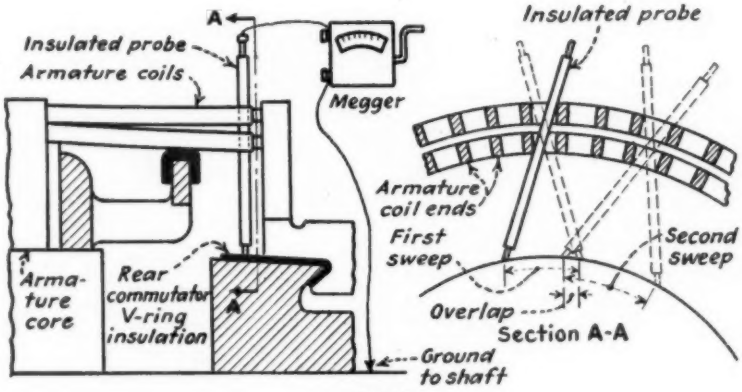


FIG.2

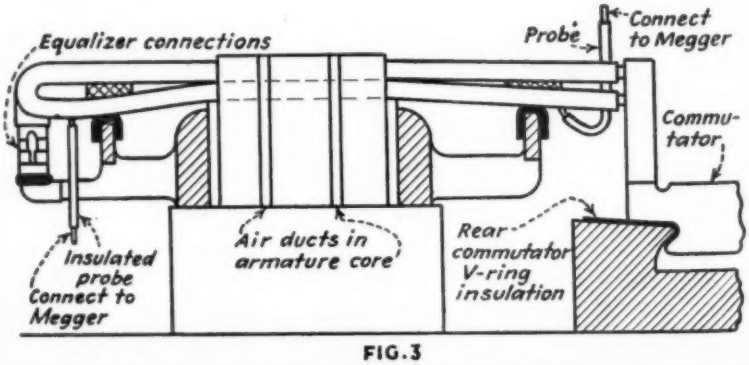


FIG.3

Fig. 1—Direction of ventilation-air flow through dc-motor and generator armatures by natural fan-action. Fig. 2—Method of probing a commutator V-ring insulation to determine area of low resistance. Fig. 3—Probing armature coils behind equalizers and commutator risers for low insulation resistance

THE OPERATING ENGINEER

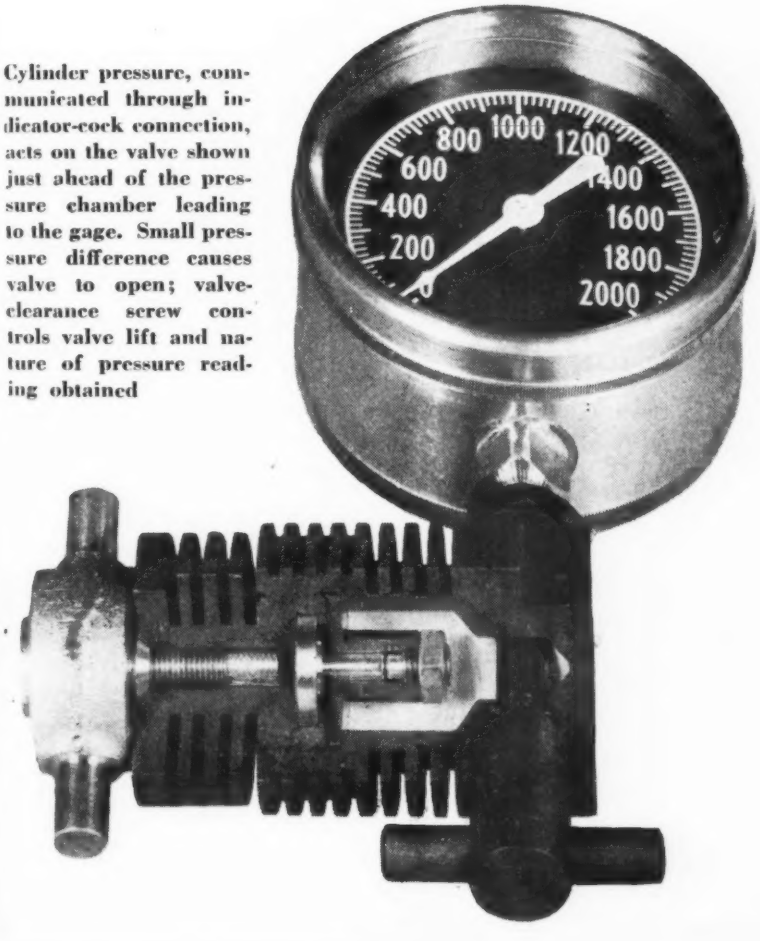
George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS → ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Easy-to-Use Indicators Keep Diesels at Peak Efficiency

By revealing maximum and compression pressures in engine cylinders, simple and rugged instruments enable operators to spot faulty combustion conditions, adjust fuel injection for best peformance and balance load between cylinders



Cylinder pressure, communicated through indicator-cock connection, acts on the valve shown just ahead of the pressure chamber leading to the gage. Small pressure difference causes valve to open; valve-clearance screw controls valve lift and nature of pressure reading obtained

THE KEY to peak diesel performance lies in knowing what goes on inside the engine cylinders. In them air is compressed, fuel injected and burned, and power produced. If all these steps in the cycle take place at the right time and temperatures and pressures hold the correct levels, high efficiency results; if valves stick, injection starts too early or too late, gas blows by the piston rings or other mechanical defects throw operation out of line; efficiency and, to some extent, capacity suffer.

Fullest answer to the question, "What's going on in the cylinders?" comes from the interpretation of indicator cards (POWER, March, 1944, p 161; April, p 244; May, p 301) but complete indication generally proves practical only on low- or medium-speed engines and meets the objection that the procedure is somewhat complicated for regular routine. Consequently a number of simple and rugged indicating devices have been developed for the quick and easy determination of part of the data gained from indicator cards.

Instead of measuring pressure at each point in the cycle and plotting it against volume in the form of an indicator card, these devices read, in one way or another, pressure at one or two points in the cycle. Usually pressure is read at end of compression and at the peak point during the com-

bustion period. These readings offer much useful information.

In the diesel, a compression-ignition engine, proper functioning depends to a large degree on attainment of correct compression pressure. It must be high enough to insure the temperature conditions needed for prompt ignition of injected fuel and the required rate and completeness of burning. On the other hand, compression pressure should not be too high; the higher the pressure the more energy must be subtracted from the useful output to perform work of compression. Furthermore, starting at a high-pressure level means that the burning phase takes place at higher pressure and thus peak pressure reached may prove excessive. The fact that the high temperature resulting from excessive compression pressure tends to accelerate burning and produce a rapid pressure rise may further aggravate this condition.

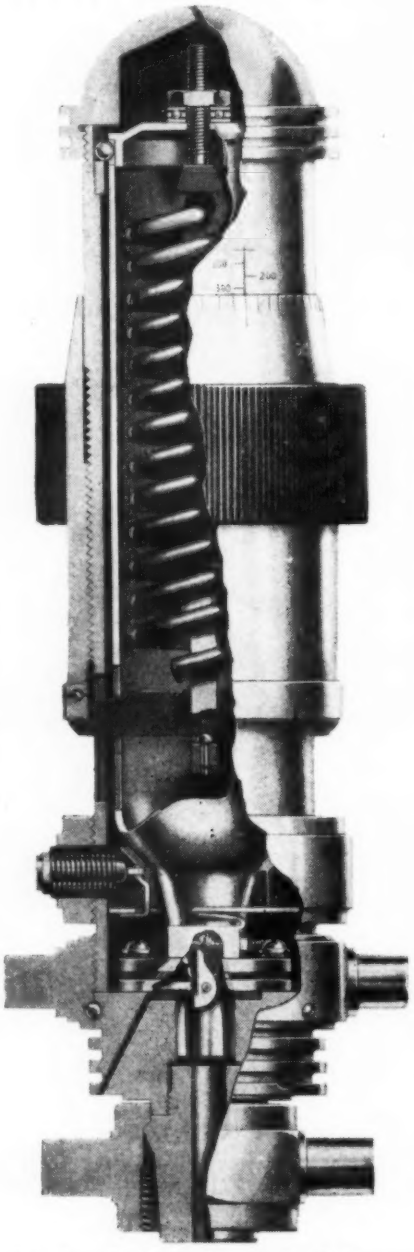
For each engine there is a range of compression pressures which produce best operation and each engineer should know the one for his diesel. Ask the manufacturer for the proper range, or determine it by tests and operating experience. Once determined, measure compression pressure regularly and compare with the standard.

Mechanical Defects

Low-compression pressure means that mechanical defects prevent taking in enough air or permit loss of pressure during compression. Typical faults include sticking or out-of-time valves, worn, loose, broken or stuck piston rings, and worn or scored pistons and liners. From these troubles come low-compression pressure and temperature and thus incomplete combustion, misfiring, irregular engine operation and fuel waste. In addition to taking toll of operating efficiency, these conditions produce smoky exhaust, carbon deposits, stuck rings and contaminated lubricating oil with resulting accelerated ring and liner wear.

As compression pressure measures suitability of engine conditions for ignition, so maximum pressure may be taken as a general measure of the proper progress of the burning stage. It is a distinctive characteristic of the diesel engine that combustion should be a controlled burning rather than an explosion. In large slow-speed engines it is often possible to control the rate of combustion so that pressure rise is extremely small, as Diesel's theory held it should be, and maximum pressure is thus low. In small-bore high-speed engines, pressure rise necessarily runs much higher and thus maximum pressure is higher than for a low-speed engine. Each diesel, therefore, has a maximum pressure range within which it operates best and, as with compression pressure, departure from correct range indicates that all is not well.

Excessively high maximum pressure usually results from too early fuel injection or from rapid combustion high-compression pressure. Early fuel injection starts combustion ahead of piston top center, producing excessive pressure rise. Injection timing is extremely sensitive and a very small advance in injection timing produces a large increase in peak pressure. Injection pressure also influences maximum pressure.



Rotating the fiber ring on the indicator barrel adjusts spring tension acting on piston exposed to cylinder pressure below. Separate neon flasher shows balance point; scale reads pressure

Regular checking of compression and peak pressures means prompt detection of unbalanced between cylinders of a multicylinder unit. This is important because if one cylinder does less than its share, engine output is reduced unless other cylinders operate overloaded, an undesirable condition.

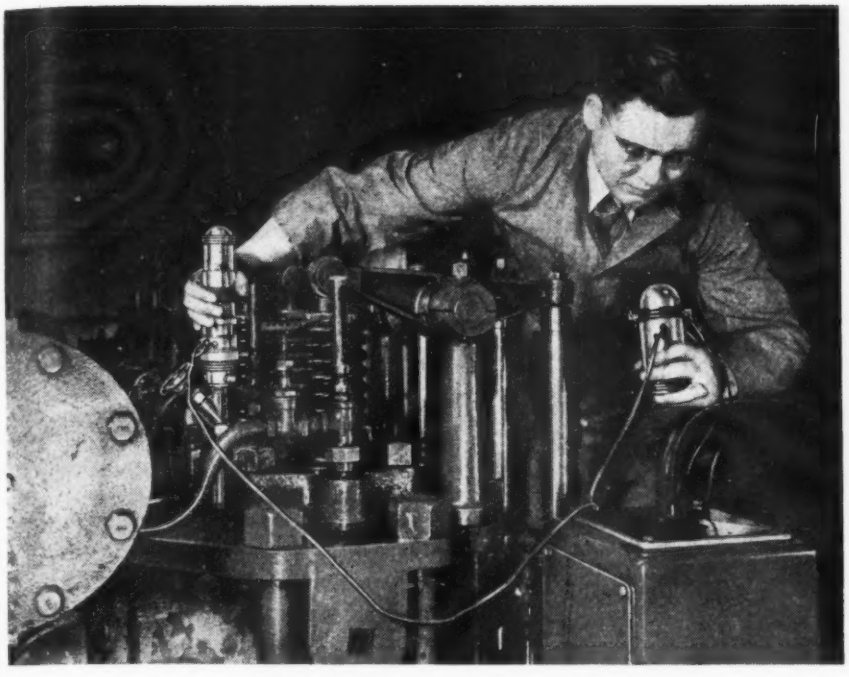
Correlated with exhaust pyrometer readings, checks of compression and maximum pressure point a warning finger at abnormal operating conditions. This permits early diagnosis and cure of minor defects before they grow into major headaches. Hence, the operator who makes good use of devices for this work can expect reduced maintenance costs, longer periods between overhauls and higher operating efficiency.

Typical pressure indicators are shown, one on the preceding page and the other to the left. The former consists of a 2-piece finned body, the section to the left in the picture carrying an indicator-cock wing nut. At the point where it threads into the other body section, which contains a pressure chamber leading to a gage, there is a valve with a stop screw that limits valve-stem motion. This valve, only moving part, is heart of the device.

Pressure from the engine cylinder is communicated through the indicator-cock connection to the valve underside. Space above the valve and its seat piece connects through small openings to the pressure chamber and pressure gage.

Controlled by Screw

If pressure in the chamber greatly exceeds that in the engine cylinder, the valve rests against the seat piece, with a wide seating area. When pressure below the valve approaches that in the chamber, the valve moves upward. Relative pressure areas, valve inertia, seat cohesion and other valve characteristics are adjusted to make the valve open when pressure below is slightly less than that above. The valve-clearance adjusting screw controls this characteristic. With screw set to limit motion of valve to a few thousandths of an inch, valve closes almost instantaneously when pressure beneath it drops. This registers the peak pressure occurring over a period of operation. If valve clearance is increased, a larger pressure differential is needed to close the valve and it thus remains open during a part of the cycle while the gage registers the pressure variations.



Operator watches neon-light flasher while he adjusts indicator, in section on page 104. When light stops flashing, he reads pressure on indicator scale

In actual use, the operator first blows out the indicator cock until a clear discharge shows. He then attaches the indicator and opens the cock. Peak pressures are best picked off with a small valve lift; for observing variations in firing pressure as load changes, the adjusting screw should be backed off to permit greater valve lift.

All lapped joints should be kept well greased with plumbago, and oil should be frequently placed in the indicator valve or connection and blown into the indicator. On engines operating under normal conditions and having good combustion, the device requires dismantling only at long intervals. However, use on engines with faulty combustion causes tar deposits in the indicator, which must be removed by dismantling and cleaning the valve and seat.

In the second typical pressure indicator, shown on this page, pressure of a calibrated spring is balanced against cylinder pressure, the balance point being shown by a neon-light flasher in a separate casing. The indicator itself connects by means of the usual union-nut fitting and contains a small piston loaded from above by a spring whose tension is adjusted by rotating an external fibre ring. The ring threads onto the indicator body and at its bottom acts against a yoke connecting to the lower end of the spring. In micrometer fashion, the indicator body carries a vertical scale and the rotating ring a vernier scale, permitting reading pressure to within two psi, over a range of 50 to 1500 psi.

Cylinder pressure acts on the piston underside, against spring pressure at the top. The piston operates a switch that connects to the neon-light flasher. As long as spring pressure is less than maximum cylinder pressure, the piston rises each time peak cylinder pressure occurs, and the neon light flashes. As the operator increases the spring tension by rotating the fibre ring, a point is reached where spring pressure balances maximum cylinder pressure and stops piston movement. The switch remains open and the neon light ceases to flash. This shows the indicator to be in correct adjustment, and the maximum cylinder pressure may be read from the micrometer scale. All operating parts are at rest when the reading is taken.

The separate neon-light flasher connects to the indicator by a 6-ft cord; it may be held in the hand or suspended from the observer's neck by an adjustable leather strap. The battery in the flasher case is a No. 950 cell.

Both of these typical indicators may be used to measure compression pressure if fuel injection to the cylinder is cut off during the test.

J C Groff has suggested measuring pressure close to the end of the power stroke, at the *release* or *pre-exhaust* point as an alternative indication of engine performance. According to tests reported by Jennings and Jackson in a paper presented at the National Oil and Gas Power Conference, Kansas City, Mo., June 1940, it is possible for a given engine to relate release pressure to brake and indicated mep and to use release-pressure values as indexes for adjusting and balancing the load among cylinders of a multi-cylinder unit.

In those tests, Jennings and Jackson used the apparatus in the diagram on this page. A tapped connection, similar to that for a cylinder lubricator, leads from a point in the cylinder wall near the end of the exhaust stroke to a triple-ball check valve. Location of the tapped hole is not critical. The check valve leads to a pressure chamber connected to a gage. When cylinder pressure exceeds that in the chamber, gas flows through the check valve and pressure builds up in the chamber. After a few engine revolutions, chamber pressure equals cylinder pressure, which is indicated on the gage. To enable the gage to follow changes in release pressure as load decreases, a slight leak-by opening is provided. The leak-by can be set to respond slowly or quickly.

If properly located connections are available, pressure indicators like the typical ones described above can measure release or pre-exhaust pressure.

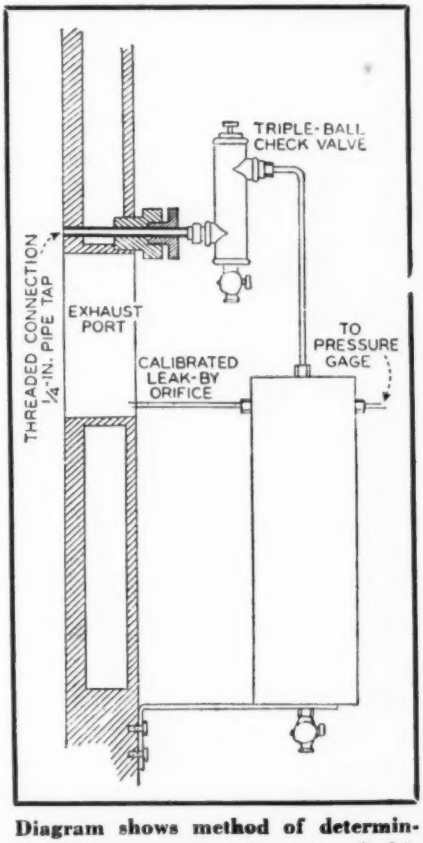
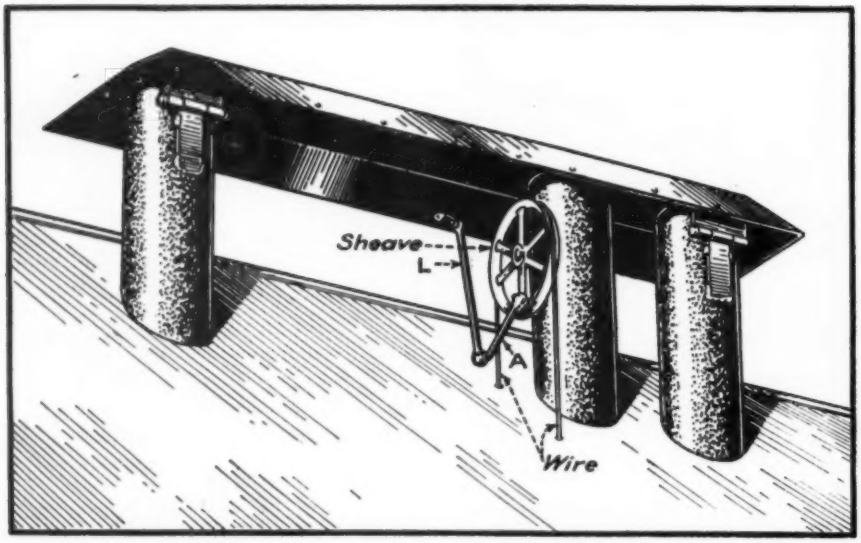


Diagram shows method of determining release pressure in tests of this procedure by Jennings and Jackson

Plant-Tested Methods and Ideas for Power Men

PRACTICAL Aids to Operation



HOOD PROTECTS ENGINE'S EXHAUST PIPE

BECAUSE OF inflammable materials near a gas-engine-driven pumping plant it was necessary to bring the engine-exhaust and carburetor-intake pipes vertically through the roof. As the plant was frequently idle for several days we had to protect the engine, when not running, against rain coming down these pipes.

The engine-exhaust and carburetor-intake pipes came through the roof in line with the ventilating pipe. This made it possible to build a galvanized-sheet-steel hood, operated from inside the plant, which covered all three pipes.

As shown, the cover hinges to the end pipes. A sheave is mounted on the center stack just below the hood. Free end of arm *A* welded to this sheave connects by link *L* to the free edge of the hood. Turning the sheave in one direction lifts the hood and turning it in the opposite direction lowers it to close the pipes. To do this from inside the plant a piano wire runs from each side of the sheave to a similar sheave near the operating floor.

Pomona, Calif. G M WILSON

Uses Wire to Gage Bearing Diameter

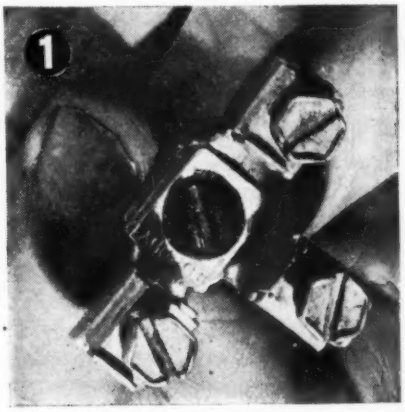
WHEN MOTOR SLEEVE BEARINGS have to be bored out and rebabbitted we send them to an outside shop. To provide a gage for the hole size in the reconditioned bearing we carefully caliper the journal and make a wire gage with rounded ends that just fits the caliper. This gage is sent along with the old bearing to guide the machinist when boring the new bearing.

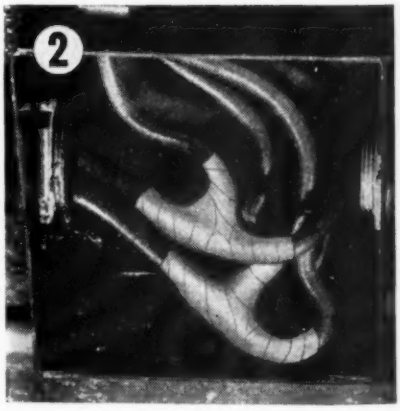
When the machinist micrometers the gage and adds to this measurement the clearance to provide in the bearing, he has the exact bore. Doing the job in this way provides the machinist with an exact gage from which to work and prevents misunderstandings. Thereafter it is his responsibility to bore the bearing correctly.

Detroit, Mich. L R CARRY

Solderless Connector Lugs Make Tap Connections

RECENTLY I took a tap for a motor connection off a line that ran through a metal junction box. The conductors were pulled through the box with very little slack so that it would have been difficult to splice-tap them and solder. It was the ideal application for a solderless tap connector. While I did not have that, I did have plenty of solderless connector lugs. From groups of three of these I made tee connectors as in Fig. 1. After bolting the connectors





together I soldered them to insure a good electrical connection.

When the tees were completed they were easily installed in the junction box by cutting the conductors in two, cleaning the insulation from their ends and tightening them in the tee heads. The branch circuit was connected in the tee legs, after which the connections were thoroughly insulated first with rubber and then friction tape. Completed connections are shown in Fig. 2.

Englewood, N. J. R BOETTINGER

Correct Speed for Reciprocating Pumps

NORMAL SPEED at which direct-acting reciprocating steam pumps can operate depends on pump size, kind of liquid and service conditions. To avoid too rapid wear and high maintenance costs, the pump's speed should be moderate, as indicated by experience and recommended by pump manufacturers. The table shows about what the piston speed in feet per minute should be for economically operated steam pumps in various services.

As length of stroke increases, piston speed also increases because there are fewer strokes. For example, a pump with a 12-in. stroke in general service has an economical piston speed of 65 ft per min. A pump with a 24-in. stroke in the same service can operate at a piston speed of 100 ft per min. To attain these piston speeds the smaller pump makes 65 strokes per min and the larger, 50.

When hot water flows through the suction pipe and valves too fast, suction pressure may drop to where flashing occurs and causes steam binding. To prevent this, operate boiler-feed pump slower than general-service pumps, or at about 66% of their speed, as shown in the table. To give heavy oil time to fill the pump cylinders these pumps are operated at a slower piston speed than hot-water-handling boiler-feed pumps, as shown in the table.

New York, N. Y. FRANK A KRISTAL

Stroke Length and Piston Speed of Reciprocating Pumps

Pump stroke, inches	*Piston speed, ft per min*					
	General service	Boiler feed	Emergency service	Fuel-oil service	Heavy-oil service	Low-head service
3	28	18	36	18	15	25
4	33	22	43	22	19	30
5	38	24	49	24	21	34
6	40	26	52	26	22	36
8	47	30	61	30	27	43
10	58	38	76	38	33	52
12	65	39	78	39	34	54
15	75	49	98	49	40	68
18	90	59	117	59	48	81
20	100	60	125	60	50	84
24	110	65	130	65	56	90
36	120	78	155	78	65	105

RADIAL GAGE NEEDS NO WORKING CENTER

FOR SCRIBING cylindrical and circular parts that do not have a center section, layout men at General Electric's Schenectady works save time by using the easy-to-make radial scratch gage, shown in the photo. The tool consists of a flat plate with two guide pins *P* underneath and a center piece on the top, which holds a slide arm *A*. The scriber *S* in the end of arm *A* can be adjusted for height. The tool will scribe a circle from a machined inner or outer diameter. A temporary center, necessary in the conventional method of laying out such parts, is not required with this tool, which can be used as shown.

Cold Chills Cause Machine Vibration

THE SUPERINTENDENT of electrical installations of one of our offices came in one day with a unique problem, as follows:

"The XYZ Company phoned that they were having trouble with one of three frequency changers, which vibrated so violently it had to be shut down. I arrived at the station the next morning and went over the machine thoroughly, checking alignment, inspecting all bearings, and testing the fields for short-circuited turns, but found everything in perfect condition.

"We cautiously started the machine only to find that it ran perfectly. Apparently everything had been normal the previous day and nothing unusual occurred until the frequency changer started to vibrate so violently that they shut it down.

"I finally found that an oil circuit breaker in the switch yard had also given trouble and had been put on a transfer car and brought in the assembly bay of the station for inspection. Floor of the bay was several feet lower than the substation floor with a rolling-door entrance in the building side. It had been about 40 F below zero and someone remembered that when the door was opened to bring in the trans-

fer car trouble developed with the frequency changer, the foundation of which formed one side of the assembly bay.

"We again opened the door to see what would happen, and in a few minutes the machine began to get rough. We closed the door and while the vibration continued to get worse for a short period, the machine soon returned to normal operation.

"Frankly, I am puzzled and want to know if you can throw any light on the situation."

I think the cause of vibration is obvious. The machine is nearly 50 ft long. We know that concrete expands and contracts with changes in temperature, and while I have no accurate figures I suspect that it expands at least as much, if not more, than steel.

Assume that foundation and machine are steel and that opening the door suddenly cooled off one side 54 deg F. This would cause shortening of one side of the machine about one quarter of a mil per inch in length, or, say, a total of about 0.150 in. If the stiffness of the frame resisted this so that you got no more than half this distortion, you would still have enough to give severe vibration. As I see it, it is a perfectly rational case of cause and effect and the obvious remedy is to wait for moderate weather before exposing the sets to outside temperatures.

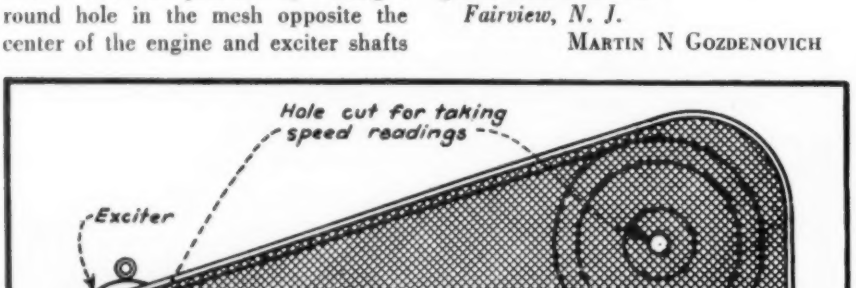
Schenectady, N. Y. N L Rea
Service Engineering Division, General Electric Co

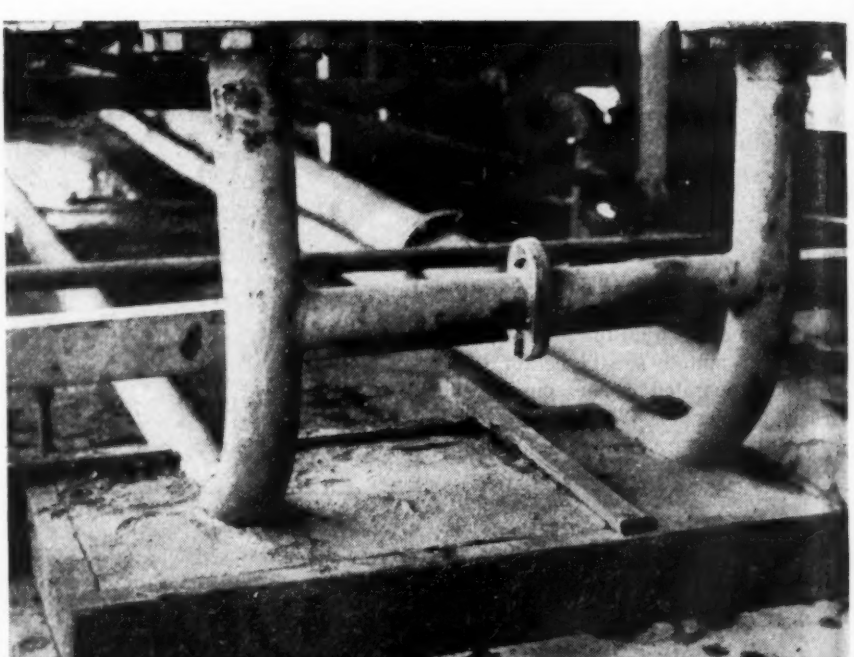
Cutting Hole in Guard Makes Speed Taking Easy

The exciter on our engine-driven generator is driven by a V-belt from the engine crankshaft. This belt has a wire mesh guard around it, bolted in place. To take engine or exciter speed we had to remove the guard or try using the speed indicator through the mesh.

We solved the problem by cutting a round hole in the mesh opposite the center of the engine and exciter shafts and protected the edges of these holes by wrapping them with friction tape, as in the figure. Now we can check the speed at any time as easily as if the guard were removed.

Fairview, N. J. Martin N Gozdenovich





CEMENT BLOCKS MAKE PIPE ANCHORS

A Pacific Coast company has solved the problem of shortages in steel anchor bolts and other hold-downs. While high-pressure steam and liquid lines subjected to heavy vibration had to be anchored firmly, they also had to be temporary enough to permit moving them at frequent intervals.

At critical points along the line, such as sharp horizontal or vertical turns, a form 2 or 3 ft square by 8 in. deep was built and filled with concrete, as in the photo. Concrete was not brought completely over the pipe so that it could be cracked away easily when the line is removed for use in a new location.

Usually the slab is quickly removed by digging a shallow trench under one side of the block, then giving the latter a smart blow with a sledge. To insure the pipe breaking away clean, that part coming in contact with the cement is first coated with grease or wrapped with paper.

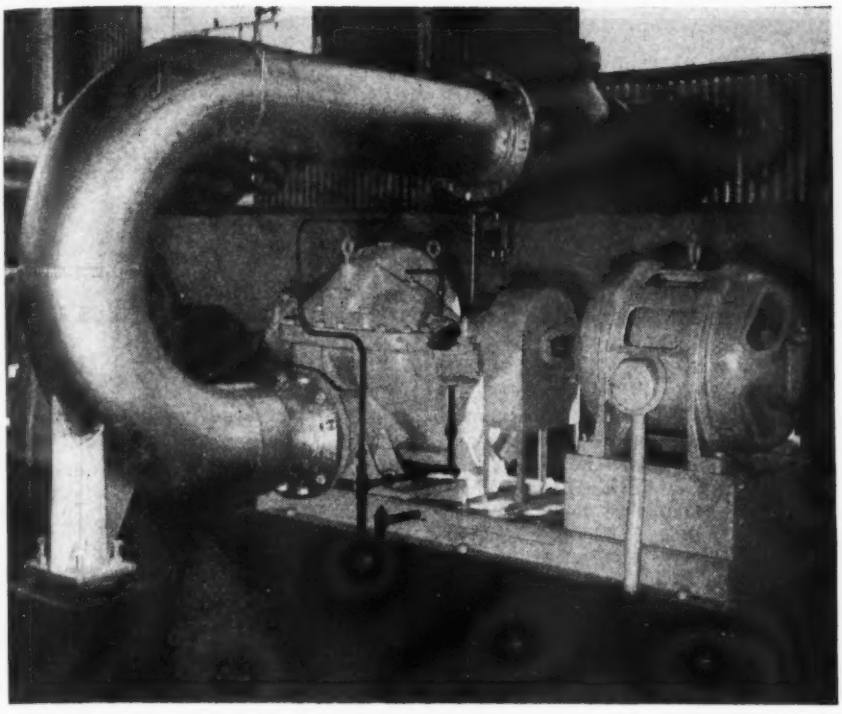
These blocks stop all vibrations at critical points and removed the cause for continually adjusting or cinching down unions, flanges and other fittings in the line.

Pomona, Calif. G M Wilson

Worn Orifice Upsets Reducing-Valve Control

Our boilers operate at 140 psi and steam for the process lines is supplied at 25 psi through a reducing valve. Recently control of this valve went wild. When boiler pressure increased, process-line pressure decreased and vice versa. After trying several expedients to correct the trouble I took the valve control apart and found the orifice badly worn, in the high-pressure connection from the steam main to the pipe connecting the pilot valve to diaphragm motor on the reducing valve. Photo shows condition of orifice, page 109.

Renewal parts are hard to get these days so I decided to make a new orifice. To do this I used a brass union as in



RIGID SUPPORT PERMITS PIPE MOVEMENT

IN THE AUXILIARY POWER PLANT at each station on the Tennessee Gas & Transmission's natural-gas line, discharge from the compressor cooling-water pumps makes a 180-deg reverse bend, as in the photo. This U-bend is made by welding together two 90-deg welding ells. To prevent this bend from vibrating or overstressing the pump casing it had to be rigidly supported yet free to move.

This is done on a stiff leg made by welding, and welded to the under side of the U-bend. It terminates on a hardened steel plate tapped for four 1-in. bolts. A similar hardened plate is set in a concrete pedestal about 2-in. below the stiffleg plate. An adjusting bolt in each corner of the top plate has a hardened round end.

These bolts are tightened down on the bottom plate to support the bend and then locked in place by a locknut on each side of the top plate. This arrangement securely supports the U-bend, without restricting its movement because of expansion and contraction and relieves pump casing of excessive stresses.

Houston, Texas CHARLES C LYNDE

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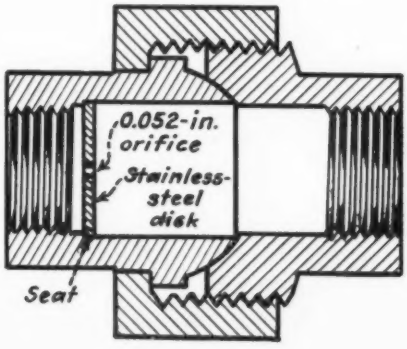
the diagram and bored it out to form a seat. On this seat I sweated a ⅛-in. thick stainless-steel disk with a 0.052-in. orifice in its center. The stainless-steel disk I made from the plug taken out of an old sylphon trap for a radiator. I estimated orifice size by the rule that an orifice should be 1/10 of pipe diameter. For a ⅝-in. pipe, orifice size figured to be about 0.06 in. To be on the safe side I tried making orifice diameter 0.052 in. Thus if it were too small I could make it larger. However, when the reducing valve was put back in service with the 0.052-in. orifice it performed as when first installed.

Englewood, N. J. R. BOETTINGER



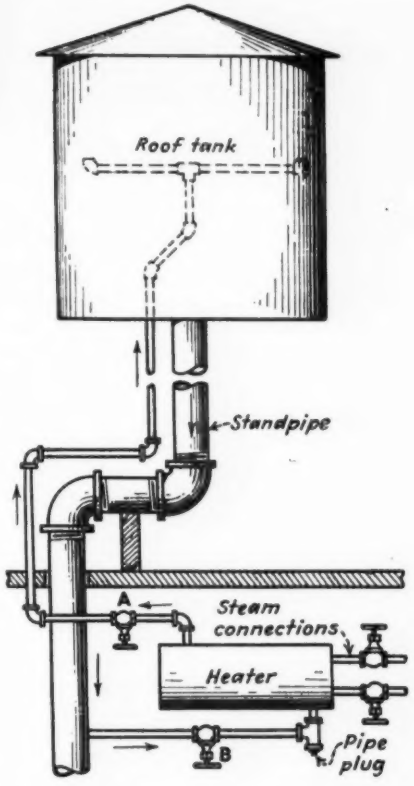
Compressed Air Cleans Roof-Tank Heater Lines

OUR ROOF-TANK HEATER is on the ceiling of the top floor. This heater connects to the standpipe and tank, as in diagram. A steam coil in the heater heats the water and it rises to the tank through the small pipe, to be replaced by cold water from the standpipe.

One morning heated water was not circulating up to the roof tank. It would have been quite a chore to disconnect the tank and clean out the line so we decided to try compressed air.

We have a small portable air compressor which we brought to the top floor. After closing valves *A* and *B* to the heater, we removed a plug from the tee bottom and drained the heater tank. Then we connected the air-compressor tank to the tee. After opening valve *A* to let the heater fill with water we opened the compressed air valve and let air blow through the heater and up the vertical pipe for a few seconds. After closing the air valve and valve *A*, we opened valve *B* and blew compressed air into the standpipe. What happened in the blowing process I do not know, but when the heater was put back in service hot-water circulation was okay.

Cleveland, O. A G WIGGINS



READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Questions from Our Readers

1—Must Air Vents Be Removed from Radiators?

OUR STORE BUILDING was originally heated by a 1-pipe steam system. Recently an outside contractor installed a 2-pipe system with vacuum return. In one area he left the air vents on several radiators and connected their returns to a common trap. As now installed we do not have heat on the upper floors and the return pump holds only a 2-in vacuum.

Could we correct this trouble by removing the air vents and fitting each radiator with an individual trap? What other faults should we look for when changing from a 1-pipe to a 2-pipe system.—*E J*

2—What Is the Best Way to Clean Chimneys?

I WOULD LIKE TO KNOW how other engineers remove soot and cinders from chimney bases. What methods can be used and what are the limitations of each? What special precautions must be observed during removal by hand?

I have both metal and brick chimneys and I am particularly concerned about possible corrosion in the former. Another inconvenience is loss of draft when opening them for hand cleaning. Future plans call for some method other than hand removal and I would like to know the advantages or disadvantages of each method.—*DAL*

Answers to December Questions

What Causes Motor Overload?

(This is Question 1 from the December issue, with best answers from readers.)

One of our power customers is having considerable trouble with a 3-phase 2300-v 25-hp 1170-rpm 100%-pf 5.3-amp capacitor motor driving a 6x6-in. ammonia compressor. Capacitor is a 15-kva 3-phase 13.1-amp unit. Also installed in their plant is a 40-hp 300-rpm 2300-v 33.3-kva 3-phase 100%-pf synchronous motor driving a 7x7-in. ammonia compressor. A separate mg set furnishes field excitation for the synchronous motor, which runs continuously without trouble.

The capacitor motor runs all week, drawing its rated current (5.3 amp) until Sunday morning when it starts drawing over 6 amp which trips the overload relay. At 8 AM the motor can be restarted and it runs at rated current until about 3 PM when it again trips.

We have plotted the load on this feeder and that on our generating station, sketch Q-1. When station load drops below 1000 kw, motor begins to draw more current. On one occasion the motor could not be operated until our station load reached 1200 kw. In several instances when station load dropped below 1200 kw the motor current started to creep up, but not high enough to trip the overload relay. Voltage on the feeder stays fairly constant at 2250.

Compressor head and suction pressure seem to have no effect on motor behavior. Once the 40-hp synchronous-motor-driven compressor was shut down with the ammonia head pressure at 140 psi and the troublesome motor still drew enough current to trip the overload relay.

I have checked every condition I can think of and all evidence points to station load as the culprit.—AWM

Look for Circuit Trouble

IT APPEARS that AWM has one of those elusive problems that occasionally crop up and yield to no reasonable solution. If voltage is correct, only the system frequency or some compressor fault is causing this trouble. It is possible that there is some sort of circuit trouble that shows up on Sundays. The fact that it shows up on that day indicates that something in the operating schedule causes the trouble. High frequency during light load might increase the motor load and, since it is protected with an overload relay set at 6 amp slight overload opens the relay. It may take a little time to find this trouble but it is likely caused by some simple thing that was overlooked.

Carlsbad, N. M. E A ROBERTS

Cut Out the Capacitor

ENGINE SPEED at minimum load and not station load is the culprit and therefore we shall consider the capacitor or condenser motor with the peculiar relationship which exists between impressed voltage and current in a circuit containing inductance and capacity.

The larger the condenser capacity the higher will be the charging current which flows in or out of the condenser. Therefore, the lower will be the opposition which the condenser offers to the flow of ac current. Effect of the condenser to current flow is known as capacity reactance (Xc), thus: $Xc = \frac{1}{2\pi fc}$

where

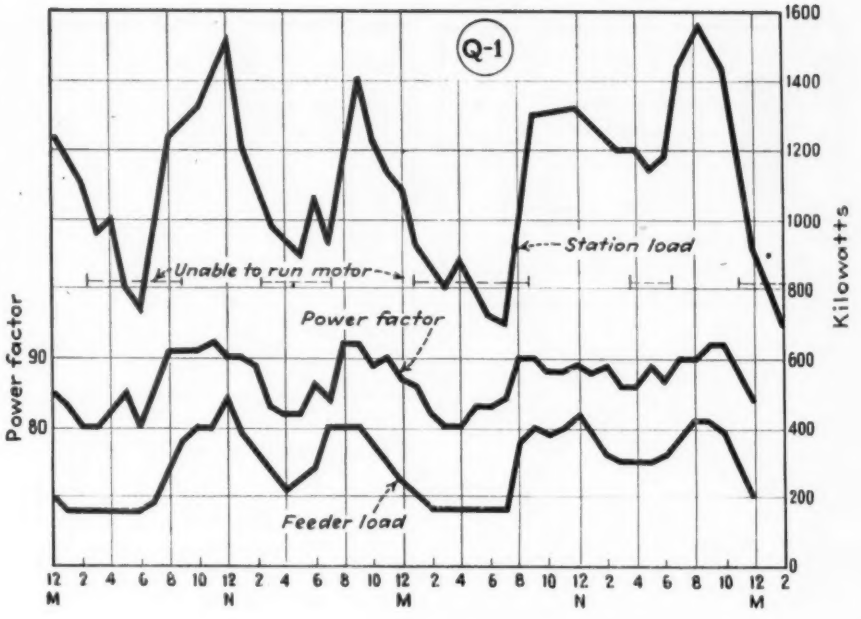
Xc = capacity reactance in ohms
f = frequency in cycles
c = capacity in farads

It can be readily seen that the condenser reactance increases as the capacity or frequency decreases (change in engine speed). Thus it is responsible for the overload of the thermal relay.

I suggest as a possible remedy or elimination of this motor overload: (1) Operate the motor over weekend without capacitor. (2) Install a frequency meter in the customer's plant to check frequency regulation at the generating plant.

Frequency variations may be caused by a new and/or economically inclined operating engineer, when operating the generating station at low percentage of total kw output, or it may be caused by some defect in the engine governor.

Glenwood Springs, Colo. CARL BACHMANN



Change the Trip Relay Setting

SYSTEM LOAD CURVE submitted by AWM shows a low power factor condition when the 25-hp motor is off the line. Presumably both motor and capacitor connect to the load side of thermal relay, *A*, sketch 1-*A*. I suggest that he move the capacitor connection to the line side of thermal relay, and either install a separate safety switch or make the connection permanent, *B*, sketch 1-A.

Perhaps the easiest way to correct the trouble is to change the relay trip setting or install a higher amperage heater.

Silverton, Colo. HAMMOND MATHEWS

Overvoltage at Motor Terminals

IN THE QUESTION concerning excessive current taken by a 25-hp motor at light load on the feeder and station, AWM states that the feeder voltage stays fairly constant at 2250 v. However, he does not say whether voltage represents supply or load end of the feeder.

Normally, a long feeder containing a high percentage of inductance and feeding a capacitor bank at the end, may cause a rise in voltage at the end at light or no load. I suggest that the motor voltage be checked to determine whether it is excessive at light load. What is the size, length and spacing of power conductors leading to the motor? Perhaps there are other capacitors on the feeder.

Normally, a motor operating with a capacitor bank rated in kva at less than 95% of the motor's rated horsepower should give no trouble, either in operation at light load or on opening the motor circuit.

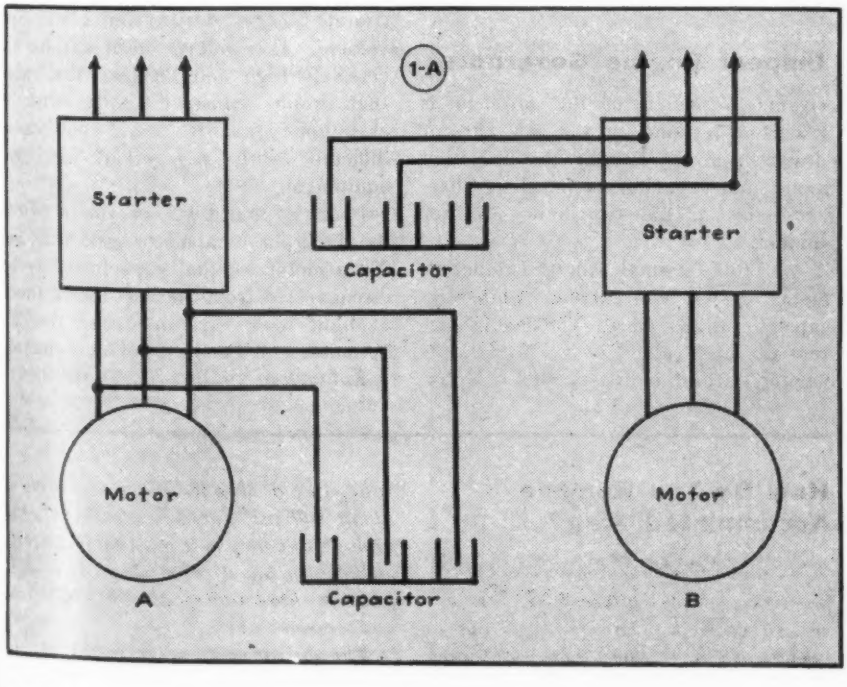
Kansas City, Mo. B. J. GEORGE

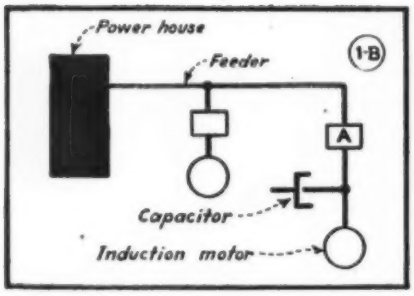
Raise Thermal Relay Setting

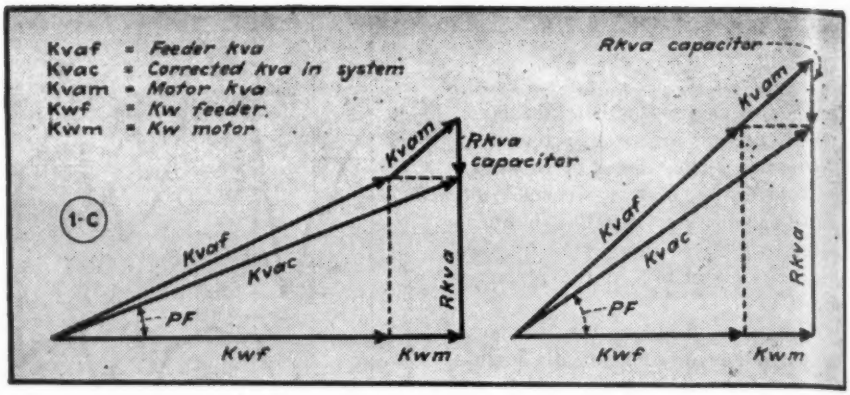
THE SOLUTION to AWM's problem is apparent if we assume that (1) the 25-hp motor starter is connected ahead of motor and capacitor (2) the motor is near the end of the feeder serving customer's load.

A condenser will correct power factor only in the feeder between it and the source of power by drawing leading current from the line. Referring to sketch 1-B the 15-kva capacitor connected to the 25-hp induction motor terminals improves the feeder power factor only between point *A* and the powerhouse. Power factor of the motor is not actually affected and retains its value, which for any given load is a function of the motor constants. Adding the capacitor offsets inductive reactive kva required by the machine so that the total effect of the motor-and-capacitor combination on the feeder is the same as if a unity power-factor machine were substituted for it. Actually this effect is obtained by correcting an equivalent value of reactive kva in the feeder.

Load curve, sketch Q-1, shows that during off-load periods when tripping







occurs, feeder power factor is approximately 0.8 compared with 0.9 at normal load. Because the feeder power factor decreases with decreasing or light loads, it is possible to have a condition where reactive kva actually increases. Under this condition the corrected pf at point *A*, sketch 1-B, decreases. Assuming the 25-hp motor is running at constant load this results in a larger current through the starter and increased heating in the thermal strip.

To illustrate: If the feeder operates normally with a 300-kw load at 0.9 power factor, feeder kva is 333 and the reactive kva is 145, from the following relationship:

$$rkva = \sqrt{(kva)^2 - (kw)^2}$$

At a reduced load of 200 kw and 0.8 power factor the kva is 250 and rkva 150. Sketch 1-C shows how reactive kva can increase with a decrease in load and power factor.

Previous figures include the corrective effect of the 15-kva capacitor and represent a net loss of correction in the system of 5 rkva—all, in effect, at the expense of motor power-factor correction viewed from point *A*.

The effect of a lower power factor and a lower voltage at point *A* is an increase of current at this point as can be seen from the relationship.

$$I = \frac{hp \times 746}{E \times pf \times 1.73 \times eff}$$

A drop in power factor at point *A*, sketch 1-B, from 0.9 to 0.8 raises the current at this point from 5.3 to 6.15 amp provided motor power factor is 0.8 or less.

I offer these solutions: (1) Raise thermal relay setting if it amply protects the motor at higher setting. (2) Do not operate unessential motor loads during low-load periods. (3) Avoid operating induction motors at light loads. (4) If the 40-hp synchronous motor is on same feeder as the induction motor, operate it lightly loaded but at maximum field excitation. (5) Add more capacitors near end of feeder if economically warranted.

Brooklyn, N. Y. H C Bauman

Frequency May Be High

Curves given by AWM indicate that the motor always trips off during the night. Perhaps the night operator at the power plant is not holding the frequency down during light load. A 10 to 12% increase in frequency, voltage constant, would account for the peculiar behavior of the motor and its capacitor. The synchronous motor is not so sensitive to frequency changes and so rides through.

Schenectady, N. Y. L W Riggs

Check Unbalanced Phase Voltage

Tripping of the motor overload relay may come from unbalanced phase voltage caused by unequal load distribution across the 3-phase system at light loads. I suggest AWM check the voltage and current at each motor lead.

Remedy, of course, is to balance the single-phase loads across the three phases.

Estevan, Saskatchewan C A Moore

Inspect Engine Governors

Overload device in the problem is wired to respond to the net current drawn from the line by the induction motor and capacitor in parallel. Characteristics of the two units are not similar.

At 110% normal voltage induction motor draws less current, while the capacitor draws more. The motor current decreases about 6 or 7%, and capacitor current increases 10%. Motor power factor drops about 2%. Current drawn from the line remains about the same as at normal voltage. Thus increased voltage does not cause the trouble.

With frequency above normal the induction motor runs faster and the load increases, which requires a higher motor current. Motor power factor will show a slight improvement. Capacitor current will also increase in proportion to the frequency. Net result will be a higher current drawn from the line.

The difficulty seems to be in the generator-engine governors. The frequency should be held within a limit of plus or minus one percent.

Hamilton, Ont. J A Cauldon

Check Line Voltage

In AWM's problem the voltage stays fairly constant at 2250 v. However, the trouble definitely indicates varying voltage. Capacitors are extremely sensitive to this.

I suggest that if AWM procures a recording voltmeter he will find the trouble occurs during times of high voltage. This voltage need not be excessively high and, in fact, the value that would cause difficulty with a capacitor probably would not cause difficulty with any other electrical equipment.

I suggest that AWM provide a switch for the 3-phase capacitor used with the 25-hp motor, so that capacitor may be disconnected from the line during times of light load, thus operating the 25-hp motor as a standard induction motor.

Kalamazoo, Mich. E E Norman

How Do You Remove Accumulated Slag?

(This is Question 2 from the December issue, with best answers from readers.)

We operate *five boilers fired with pulverized coal. We have been trying to keep waterwall tubes and roof-screen tubes free of slag by lancing with air at about 100 psi. The lance soon gets hot enough to bend, so it must be frequently withdrawn for straightening. It is difficult to blow accumulated slag from roof-screen tubes.*

The operation is a severe tax on our

air-compressor capacity, which was installed primarily for instrument use and boiler controls. For both the above reasons we are thinking of lancing with a water jet. We have service water at 125 psi, and feedwater at 350 and 1050.

I would like advice on which is the most effective (1) continuing to use air (2) using air and water mixed or (3) using a small high-pressure water jet alone; and how best can damage to refractory and tubes be avoided? Boiler waterwall tubes are all 3¼-in., on 7½-in. centers in front and rear walls and on 4¼-in. centers in side walls. Back of these are 2-in. book tile in side and rear walls, and 9-in. Bigelow-Liptak blocks in supporting front wall, all inside a steel casing with insulation.—HAS

Uses Water on Refractory Surface

WE HAVE HAD TO RESORT to a water jet to remove slag from boilers that have no waterwalls. Therefore more refractory surface is exposed to the water. To date we have had no evidence of brickwork deterioration.

Instead of lancing under full load we drop the boiler affected and remove accumulated slag from the tubes, sidewalls and arch with a ¼-in. jet of cold water at 100 psi. We do not recommend this as regular practice because at best it does a poor job, but it enables us to get by in emergencies.

Estevan, Saskatchewan C A MOORE

Check Heat Release

WIDE TUBE SPACING in HAS's boilers should prevent appreciable slagging unless the ash has low fusing temperature, furnace temperature is high or waterwall surface inadequate. This could be summed up by saying that furnace volume or cold boiler surface is too small for the amount of heat released. If the two latter conditions cannot be corrected, use coal with a higher ash-fusion temperature. However, closely spaced tubes introduce a capacity limitation in some boilers and the only remedy is to improve the fuel and combustion conditions, or remove the boiler from service periodically for hand cleaning.

Mechanical devices that remove slag in almost any form have been greatly improved in recent years. This improvement hinges largely upon the use of large quantities of steam or air for short periods. These so-called mass blowers use either multiple nozzles permanently located far enough from the tubes to prevent tube cutting or retractable single nozzles that can be projected into the furnace as needed, either just through the wall or progressively across the furnace opposite the surface to be cleaned. These retractable blowers can use steam, air or water. Experience shows that applying a large force for a short time is more effective than using a similar total quantity over a longer period.

Lack of sufficient air at reasonable pressure appears to cause the present trouble. The air compressor installed primarily for instrument and control

(*Continued on page* 136)

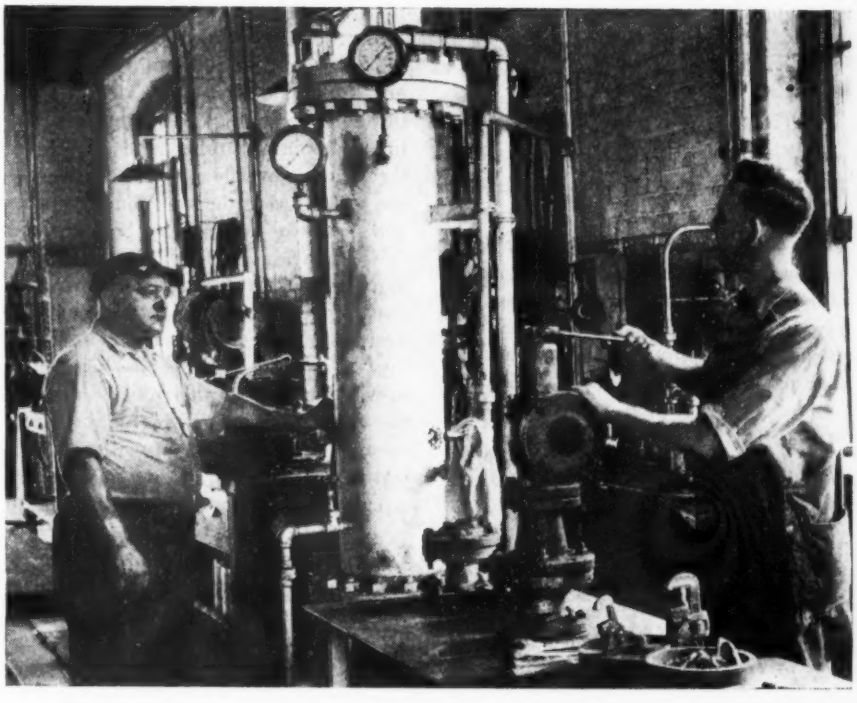
Testing Steam-Boiler Safety Valves

▶IN EARLY DAYS boilers were relatively small, steam pressures low, and pressure fluctuated greatly so that safety valves were operated automatically each day. Furthermore, poor feedwater required that the boiler be opened frequently for internal cleaning, which offered ample opportunity to clean and regrind safety valves at reasonable intervals. From this background grew the traditional practice of operating safety valves daily, either automatically or manually.

As boiler pressures increased it became apparent that popping safety valves should be avoided if their dependability could be determined in any other way because pressures are now maintained close to the popping point. The ASME Boiler Code, Par P-281, provides for maximum blowdown of 4% of the set pressure; therefore, a safety valve operated manually, with pressure above the closing point, might result in considerable pressure drop and waste of steam.

Some safety valves can be checked to determine whether they are free by carefully pulling or jarring the lever just enough to cause a spit, but without actually blowing even when the boiler pressure is above the seating point. When a boiler is removed from service its safety valves should be popped automatically.

For these reasons we recommend that operators of high-pressure boilers keep a log of safety-valve tests made when boilers are removed from service. Record the date of test and performance of each valve. Elapsed time between tests depends on the type of valve and plant conditions in general, but consider six months the maximum safe interval for boilers supplied with good feedwater and receiving expert maintenance.—J P Morrison in *The Locomotive*.



Q&A — QUESTIONS & ANSWERS FOR POWER ENGINEERS

By ALEX HIGGINS

23—*Injectors and Pumps*

Announcing a New Series

This is the final chapter of Alex Higgins' questions and answers on boiler room practice. Although all good things must come to an end, the editors will miss his familiar face on these pages.

This cloud, however, has not just one but two silver linings. POWER readers will be glad to learn that this immensely popular series will be republished some time in 1945 as a McGraw-Hill book. Second, termination of these articles will be followed by a new series of questions and answers on centrifugal pumps, by I J Karassik and Roy Carter, experts in this important field.

Starting in the March issue, these articles will give a broad, practical understanding of centrifugal pumps, their construction, operation, characteristics, troubles and remedies.

Q 1—*What means are used to force water into a steam boiler against boiler pressure?*

A—Principal devices to feed water into steam boilers are injectors and pumps, though under certain circumstances an outside source of water supply may be suitable if pressure is high enough and supply constantly available. Low-pressure heating boilers, for example, are often fed from city water mains.

Q 2—*Sketch a single-tube injector and mark names of principal parts.*

A—Fig. 1 is a sectional view of a single-tube lifting injector with principal parts marked.

Q 3—*Describe construction and operation of the single-tube lifting injector.*

A—This injector uses direct steam pressure to force water into a boiler against the same steam pressure as that which operates the injector. A brass casing contains an expanding steam nozzle, several converging and diverging tubes, which form one practically continuous passage, and a check valve.

When the steam valve is opened, steam enters the injector through the expanding steam nozzle, which converts its pressure energy into velocity. Entering the suction tube, this high-velocity steam jet creates a partial vacuum in the suction pipe. Water is then forced up the suction pipe into the injector by the unbalanced atmospheric pressure on the surface of the water supply. This water mixes with, and condenses, the steam. Some of the steam's velocity is imparted to the combined jet of condensed steam and water as it passes into the tube, and this velocity is again partly converted into pressure in the delivery tube—enough to enable the stream of water flowing through the pipe to lift the check valve and enter the boiler.

Until the jet of water is properly established in the combining and delivery tubes, steam and water escape through the small holes in the sides of the combining tube and pass out through the overflow valve. As soon as the water has gathered enough velocity and pressure to lift the boiler check valve, it passes through the combining and delivery tubes in an unbroken stream, creating a partial vacuum in the overflow chamber, which lifts the sliding washer up against its seat, thus preventing any inrush of air through the overflow opening that might break up the jet. This injector will automatically resume work after a momentary interruption in flow without having to be adjusted by the operator.

Various pressure and velocity changes that occur in the injector depend on the design of nozzles and tubes. The diverging steam nozzle allows the entering steam to expand with a consequent fall in pressure and increase in velocity. The converging suction and combining tubes increase the velocity of the water jet, and the expanding delivery tube decreases the velocity of the water jet and increases the pressure. Note that an expanding nozzle *increases* steam velocity but decreases water velocity, because steam can expand indefinitely while water cannot expand much.

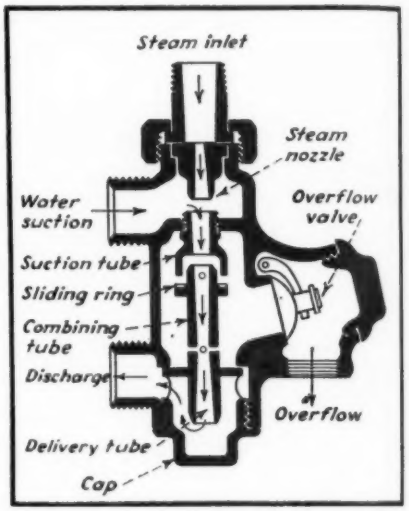


Fig. 1—The single-tube lifting injector makes use of direct steam pressure

Q 4—*Sketch a double-tube injector and name the principal parts.*

A—Fig. 2 shows a sectional view of a double-tube injector with names of parts.

Q 5—*Describe construction and operation of a double-tube injector.*

A—It handles hotter water than the single-tube injector and works with a greater lift. It also operates with lower steam pressures and against higher boiler pressures. In operation, one tube lifts the water from the source of supply and delivers it to the other tube, which forces it into the boiler.

Capacity of the injector, Fig. 2, can be adjusted by the regulating valve ad-

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Q&A FOR POWER ENGINEERS

(*Continued from page* 114)

mitting steam to the lifting tube. The lever handle operates the main steam valve, forcer steam valve and main overflow valve. Main steam valve and forcer steam valve are operated by the same valve stem, their construction being such that the main steam valve can be opened a certain amount before the forcer steam valve opens.

To start the injector, assuming regulating valve is properly adjusted, pull the lever handle to the right, just enough to open the main steam valve. This admits steam to the lifting tube steam nozzle through the regulating valve. The entering high-velocity steam jet creates a partial vacuum in the suction line and lifts water from the supply source. Combined-steam-and-water jet issuing from the lifting tube fills the injector body and escapes through the auxiliary and main overflow valves.

Pulling the lever handle farther to the right opens the forcer steam valve and closes the main overflow valve. Steam from the forcing steam nozzle then forces the water being supplied by the lifting tube into the forcing tube from which it discharges with sufficient velocity to lift the boiler check valve and enter the boiler. As the main overflow valve closes, the pressure equalizes on both sides of the auxiliary overflow valve and it closes automatically.

To stop the injector, pull the lever handle to the left, closing both main steam valve and forcer steam valve.

Q 6—*What is meant by lift of an injector?*

A—It is the vertical distance from the injector to the surface of the water supply, when the injector is located *above* the supply source. Practically all injectors are of the lifting type, but it is best to place an injector as close to the water-supply surface as possible because a high-suction lift cuts down the capacity. The limit of practical suction lift at sea level is not much over 20 ft and it is less at higher altitudes because of the lower atmospheric pressure.

Q 7—*Explain why an injector can lift water from a lower level and why it will not lift very hot water?*

A—An injector lifts water because the high-velocity steam jet entering the injector exhausts air from the suction pipe and creates a partial vacuum in the pipe and injector. Then the unbalanced atmospheric pressure on the surface of the water supply forces the water up the pipe into the injector.

If the feedwater is very hot two things happen: (1) Entering steam momentarily creates a partial vacuum by exhausting the air from the suction pipe but continuance of this partial vacuum depends upon the incoming feedwater condensing the steam, and this does not occur at all if the feedwater is too hot. (2) Injector becomes *steambound*. Creation of a partial vacuum in the suction pipe may cause water in the pipe to evaporate into steam, as lowering the pressure also lowers the boiling point. If this happens, the suction pipe fills with steam and no water enters the injector.

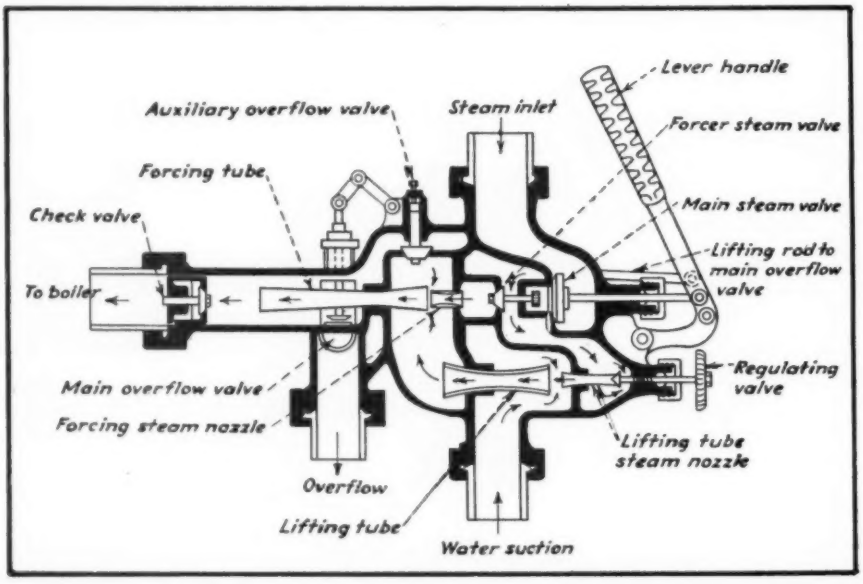

Fig. 2—In the double-tube injector, one tube delivers water to the other tube

Q 8—*What are the advantages and disadvantages of an injector as a boiler feeding device?*

A—Advantages are: (1) It is small and very compact. (2) Its first cost is low. (3) Upkeep and repair costs are low. (4) It has practically no moving parts. (5) Of very simple construction, it does not readily get out of order. (6) It requires no lubrication. (7) It is easily operated. (8) It has high *thermal* efficiency. This means that practically all heat in the steam used to operate the injector is also used in heating the feedwater. Only heat loss is the small amount of heat radiated from body of injector. (But note that this "efficient" heating of feedwater by live steam makes it impossible to take full advantage of otherwise wasted exhaust steam to heat the feedwater.)

Disadvantages are: (1) It cannot handle very hot water. (2) Because of limited delivery range its operation is usually very intermittent unless boiler is carrying a steady load and injector delivery can be regulated to keep a steady water level. (3) With varying load injector must be started and stopped frequently and there is danger that water level may drop below the safe minimum level when injector is not in operation. (4) It does not operate efficiently on superheated steam. (5) It has low *mechanical* efficiency compared to a pump, its steam consumption being greater for the same amount of work done in forcing water into the boiler.

Q 9—*What are some of the common reasons for an injector failing to work properly and efficiently?*

A—Failure or inefficient operation may be due to: (1) Feedwater too hot. (2) Suction lift too high. (3) Leaks in suction pipe destroying vacuum. (4) Steam pressure too low. (5) Wet steam preventing proper condensation of steam jet. (6) Nozzles and tubes scaled up or plugged with dirt. (7) Suction hose collapsed internally, if hose is used. (8) Obstruction in suction or discharge line. (9) Worn-out injector parts. (10) Leaky boiler check valve, allowing steam to blow back into injector discharge line.

Q 10—*If an injector does not work properly, what should you do to find and remedy the trouble?*

A—Repair leaks in suction pipe or run a new suction line. Take injector apart and examine nozzles and tubes to make sure that passages are clear and parts not badly worn. If tubes are

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Q&A FOR POWER ENGINEERS

(*Continued from page* 116)

scaled they may be cleaned by soaking for several hours in a dilute solution of muriatic acid, about one part acid to ten parts water. Remove any iron or steel parts before placing the injector in the acid. If any parts are worn out replace them with new parts.

Make sure that suction and delivery lines are free from obstruction, and that boiler check valve is in good working order. Wet steam may be due to the steam connection to the injector being taken off at a point where considerable water comes over with the steam, in which case it may be remedied by changing the connection to a more suitable location. If water is too hot, use colder water. If lift is too high lower injector or raise level of water supply.

Q 11—*Sketch an ejector and explain its operation.*

A—An ejector operates on the same principle as an injector but its construction is much simpler and it does not discharge against a very high pressure. It is not suited to boiler feeding. It can, however, be used for many purposes where space is limited and only small quantities of water have to be handled. The type in Fig. 3 operates

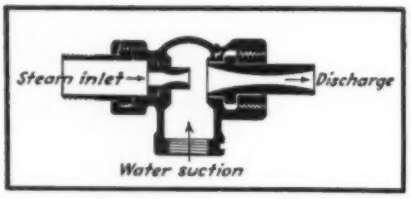

Fig. 3—While an ejector operates on the same principle as an injector, it is not suited to boiler feeding

on either steam or compressed air though steam is preferable. Steam consumption is quite high, so it should be used only where it operates intermittently for short periods.

In operation, steam or compressed air issues at a very high velocity from the expansion nozzle and creates a partial vacuum in the suction line. Water rises in the suction pipe and when it meets the steam or air jet it is forced into the discharge line.

Q 12—*Has a pump any advantages over an injector as a means of feeding boilers?*

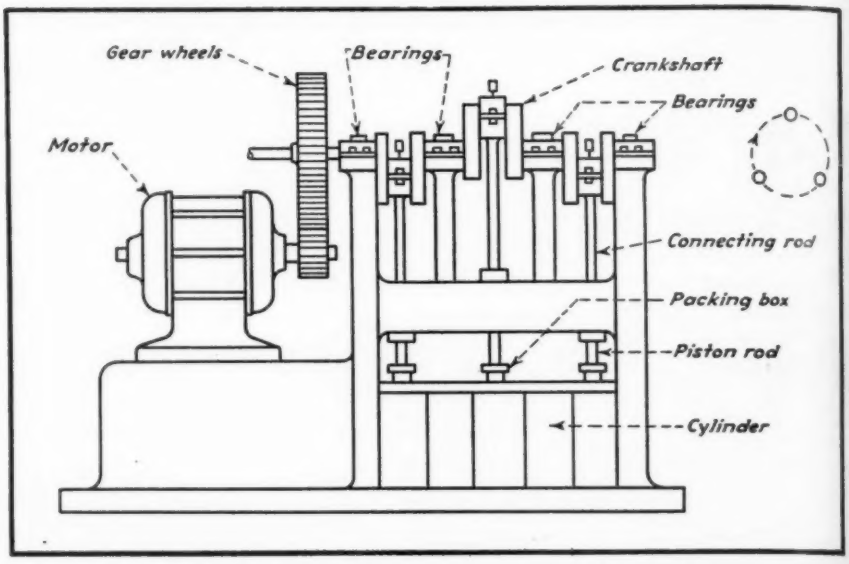

Fig. 4—Vertical gear-driven triplex pump is a common form of the power pump

A—A pump has several advantages over an injector. Most important are: (1) It can be adjusted to feed continuously at steady or varying rate and does not have to start and stop at frequent intervals. (2) It uses much less steam. (3) It handles hotter water. (4) It has a wider range capacity. (5) It permits the economical use of exhaust steam or bled steam for feedwater heating.

Because of these advantages pumps are installed in all large steam boiler plants and in most small plants as well, injectors being pretty well confined to very small stationary plants, portable and locomotive boilers.

Q 13—*How are pumps classified?*

A—General classification would be:

1. *Reciprocating pumps* (piston and plunger)
   Power-driven (simplex, duplex and triplex)
   Direct-acting steam-driven (simplex and duplex)
2. *Centrifugal pumps* (steam-turbine, electric-motor or belt-driven)
   Single-stage or multi-stage
3. *Rotary pumps* (turbine, motor or belt-driven)
   With impellers in the form of gears, lobes that mesh together like gears, or impellers in the form of sliding or swinging vanes.

Q 14—*Sketch and describe a power-driven pump.*

A—Strictly speaking, all pumps are power driven in some fashion but the term power pump is usually limited to a pump of the reciprocating type that is driven by a belt or gears from an engine, motor or lineshaft. The pump may have one, two, three or more cylinders, and the cylinders may be single or double acting. The *triplex* is a very common form of power pump. It has three cylinders set side by side, with their plungers connected to a 3-throw crankshaft. The cranks are set 120 deg apart to insure a fairly steady flow of water.

Plungers are usually *single acting*, that is, the upward stroke is a suction stroke and the downward stroke is a discharge stroke, the upper end of the cylinder being open.

Fig. 4 shows a vertical gear-driven triplex power pump.

Q 15—*Sketch a direct-acting duplex steam pump.*

A—Sectional sketch of one side of a direct-acting duplex steam pump is shown in Fig. 5. It is called a duplex pump because it has two steam and two water cylinders, placed side by side.

Q 16—*Describe the action in the water end of a duplex direct-acting steam pump.*

A—Assuming that the pump is set above the surface of the water supply, the action is as follows. When the pump is started, the movement of the pistons to and fro exhausts the air from the suction pipe and water cylinders. This creates a partial vacuum in the suction line and the unbalanced atmospheric pressure on the surface of the water supply forces water up the suction pipe into the pump cylinders. Water passes up through the suction valves into the cylinder on one stroke and is forced up through the discharge valves on the return stroke as the pressure of the piston on the water closes

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Q&A FOR POWER ENGINEERS

(*Continued from page* 118)

the suction valves and opens the discharge valves.

In Fig. 5, atmospheric pressure is forcing the water into the left-hand side of the cylinder. The piston is forcing the water on the right to flow out through the discharge valves. As the pump is *double acting*, this process reverses on the return stroke.

Q 17—*Explain the action in the steam end of a direct-acting duplex pump.*

A—Here we have two simple steam-engine cylinders set side by side, the slide valve in each cylinder steam chest being operated by the crosshead on the piston rod of the opposite cylinder, through an arrangement of rods and rocker arms.

Steam valves are the simple D type. They slide to and fro over the steam ports, admitting steam alternately to each end of the steam cylinder and exhausting it to the atmosphere when the piston stroke is almost completed. There are two steam ports for each end of the cylinder. Steam enters the cylinder through the outer port and passes to exhaust through the inner port, after it has done work on the piston. These separate ports cushion the piston at the end of its stroke and prevent it striking the cylinder heads. As the piston nears the end of its stroke it covers the exhaust port, preventing further escape of steam to exhaust. The steam thus trapped between piston and cylinder head brings the piston to rest and reverses its motion without shock.

Some pumps have hand-operated cushion valves that open or close small passages connecting the steam and exhaust passages at each end of the cylinder and so regulate the degree of cushioning. These valves should be closed at light loads to give the maximum cushioning effect and shortest possible piston stroke. At heavy loads, the cushion valves should be wide open to give minimum cushioning effect and longest possible piston stroke.

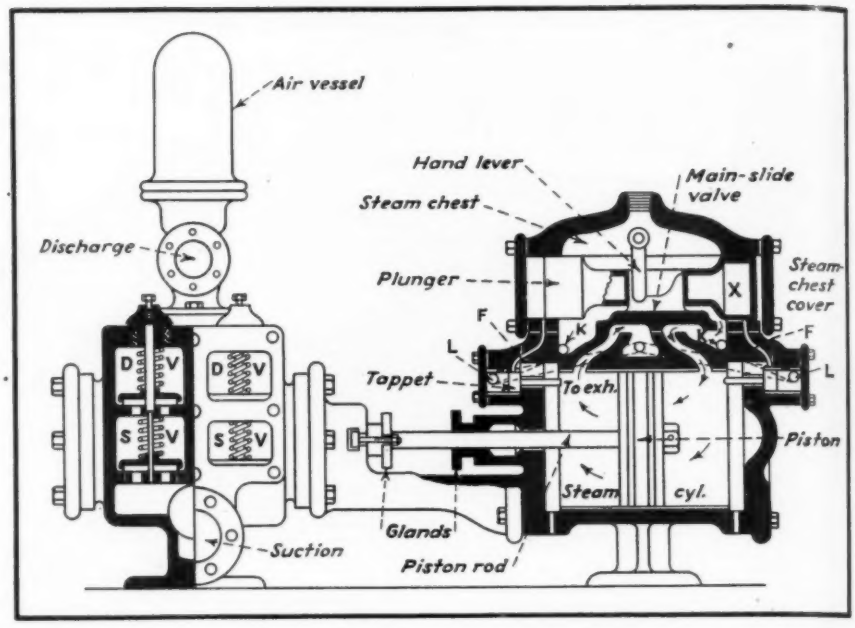


Fig. 6—In a simplex direct-acting steam pump the valves are readily accessible

As each steam valve is operated by the action of the piston rod belonging to the other steam cylinder, the pistons move in opposite directions most of the time. When one piston is momentarily stopped at the end of its stroke the other piston is in motion, thus insuring a fairly continuous water flow in the discharge line. This is one point where the duplex pump has an advantage over the simplex type of direct-acting pump. Another is its comparative simplicity of construction and operation.

Q 18—*How would you set the steam valves on a duplex pump?*

A—First step is to place the pistons in their central positions. They should be at midtravel when rocker arms are vertical, but simply moving the pistons until the arms are vertical cannot be depended upon as the crossheads may have moved on the piston rods from their original setting. Correct procedure is as follows:

1. Push one of the pistons back until it strikes the cylinder head.
2. Scribe a mark on the piston rod at the face of the packing gland.
3. Pull the same rod out until it strikes the opposite cylinder head.
4. Scribe another mark on piston rod at the face of same packing gland.
5. Find the center of the distance between these two points and mark this central point.
6. Move the rod back until the central mark is at the face of the gland and the piston will be exactly at mid-stroke. Repeat this process for other side of pump.
7. Set the slide valves exactly in the center of their travel. In this position they will just cover the steam ports with no overlap.
8. Divide the lost motion evenly on each side of the nut or nuts on the valve rod that moves the valves.
9. The setting is now complete but one of the pistons must be moved off center before turning on steam or the pump will not start, as both valves are on center, covering all the steam ports.

To summarize, valves are properly set if they just cover the steam ports, with lost motion equally divided, when the pistons are at midtravel. The term lost motion refers to the space between

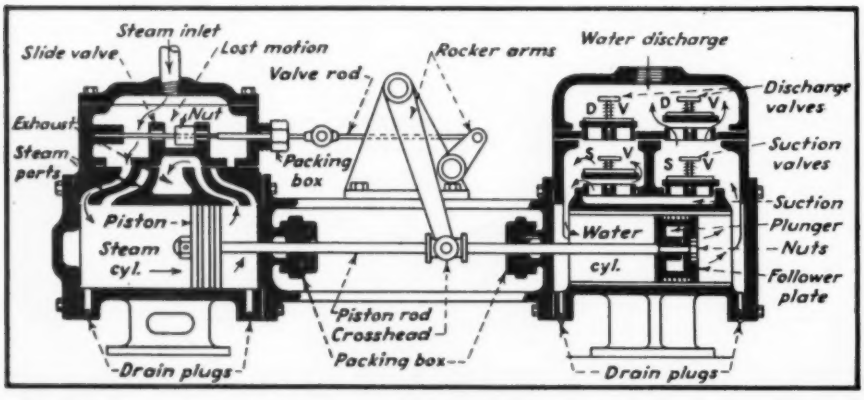
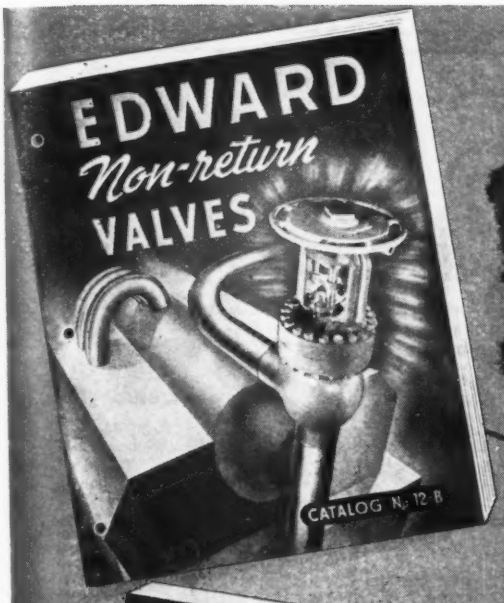
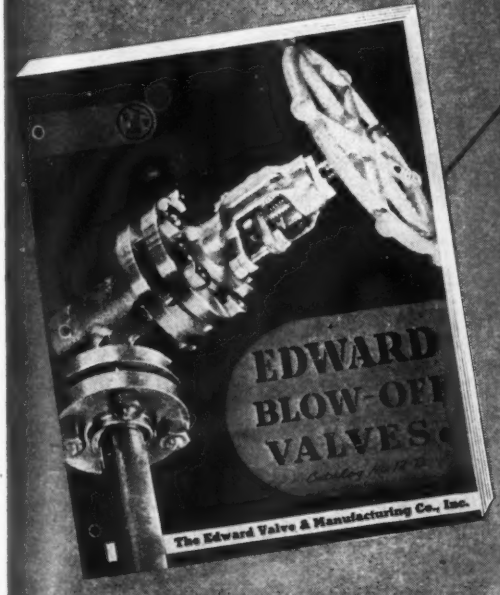


Fig. 5—Direct-acting duplex steam pump has two steam and two water cylinders





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EDWARD *Steel* VALVES

Q&A FOR POWER ENGINEERS

(*Continued from page* 120)

the lugs on the back of the valve and the nuts on the valve rod that moves the valve. This slack is necessary to let the piston almost complete its stroke before the crosshead, rods and rocker arms move the valve. If no lost motion were provided, the pistons would either remain stationary or make a very short stroke.

Q 19—*Sketch and describe a simplex direct-acting steam pump.*

A—A sectional view of a common type of simplex, direct-acting, steam pump is shown in Fig. 6. The action in water end of this pump is similar to the action in the water end of the duplex pump, but the water valves are placed at the side instead of on top of the water cylinder, as in the duplex pump. This makes the valves readily accessible without having to disconnect any pipes or remove more than one cover.

Main difference between the simplex and duplex steam pumps lies in the method of operating the steam valves. In the simplex pump, Fig. 6, the entire valve mechanism is contained within the pump itself, and there are no outside moving parts such as valve rods and rocker arms. This pump cannot *short stroke*, as the main piston must complete its travel before the main steam valve can reverse.

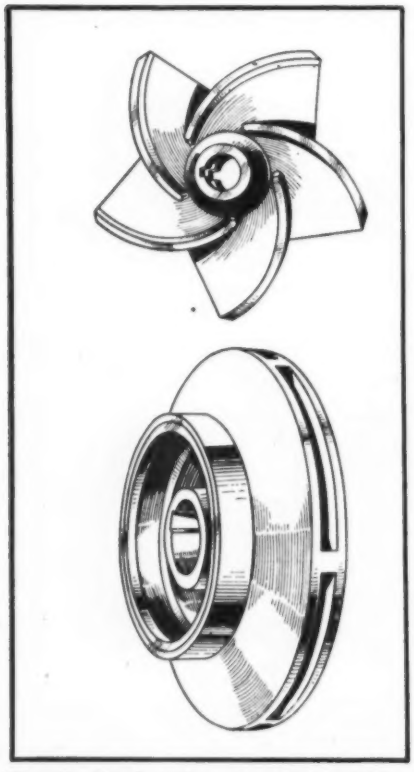


Fig. 7—Open *(above)* and closed *(below)* impellers are two common types for centrifugal pumps

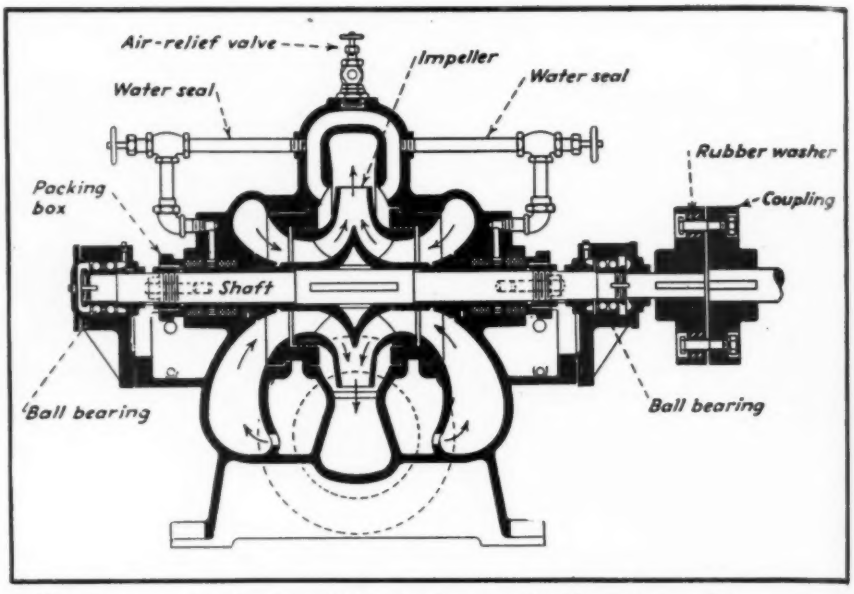


Fig. 9—A sectional view of the single-stage double-suction volute pump

Q 20—*Describe the steam-valve operation in the simplex pump shown in Fig. 6.*

A—Main steam piston is driven by steam admitted alternately to each side of the piston by a main slide valve that also allows steam to pass to exhaust when it has done its work in moving the piston. This main slide valve is moved back and forth by a plunger or close-fitting piston valve with hollow ends. These ends are open to the steam chest and are always filled with live steam, which flows through tiny holes marked (x) in the ends thus filling the spaces between valve ends and valve-chest covers with live steam also.

As pressure on the piston-valve ends is equal, it is ordinarily balanced and motionless. When the main piston travels to the end of its stroke, it strikes the projecting spindle of a small tappet and pushes the tappet back. This places passage *F* in communication with the exhaust through the passage shown dotted and allows live steam in the space at the end of the piston valve to escape to exhaust. Pressure of the live steam on that end being now relieved, the piston valve is forced over by the live-steam pressure on the other end. As it moves it carries the main slide valve with it, thus reversing the motion of the main piston by admitting steam to the opposite end of the cylinder.

As the piston valve moves over it shuts off port *F* and cushions itself on the steam trapped between end of

(*Continued on page* 176)

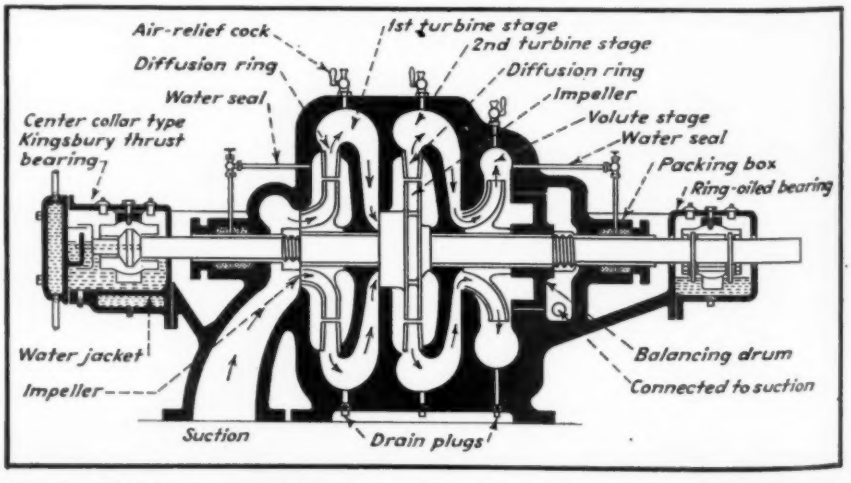
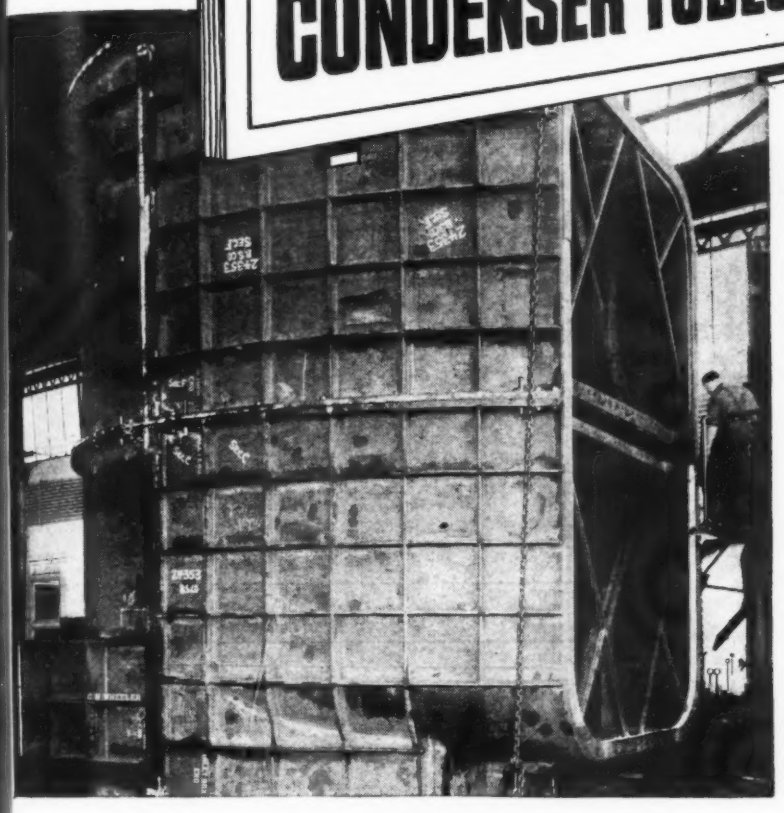


Fig. 8—This 3-stage centrifugal pump has two turbine stages, one volute stage

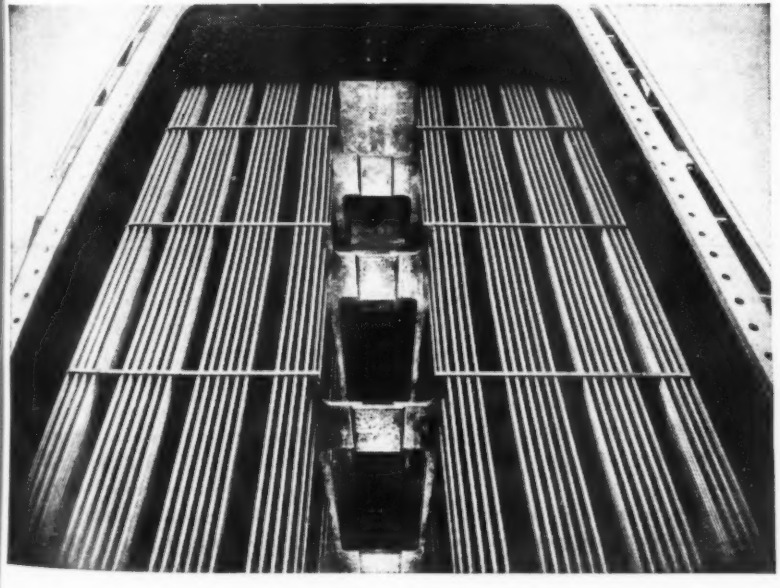
36½ MILES OF CONDENSER TUBES

...and every inch must be the same!



Above, Shell for 50,000 square foot surface condenser fabricated by C. H. Wheeler Manufacturing Company.

Below, Anaconda Muntz Metal Tubes, as seen through exhaust opening.



Eighty-four hundred lengths of Anaconda Muntz Metal Condenser Tubes provide 50,000 square feet of surface area in this public utility condenser fabricated by the C. H. Wheeler Manufacturing Company.

In the construction of such huge and costly units as this, involving quantities of priority material, selection of the correct tube alloy is of prime importance.

That is why manufacturers of condensers and heat transfer equipment so often confer with Engineers of our Technical Department . . . why Anaconda Condenser Tubes are available in a wide range of alloys.

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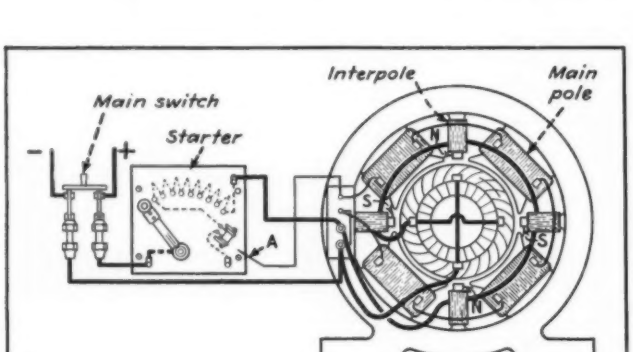
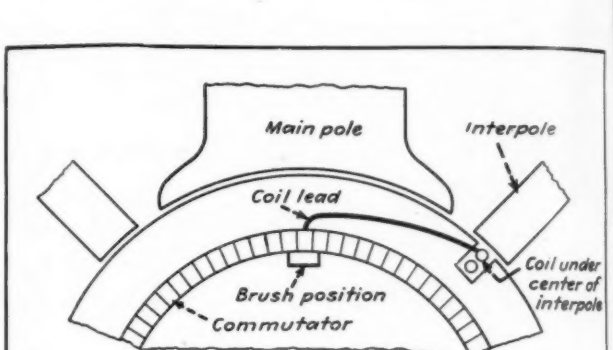
Anaconda Condenser Tubes

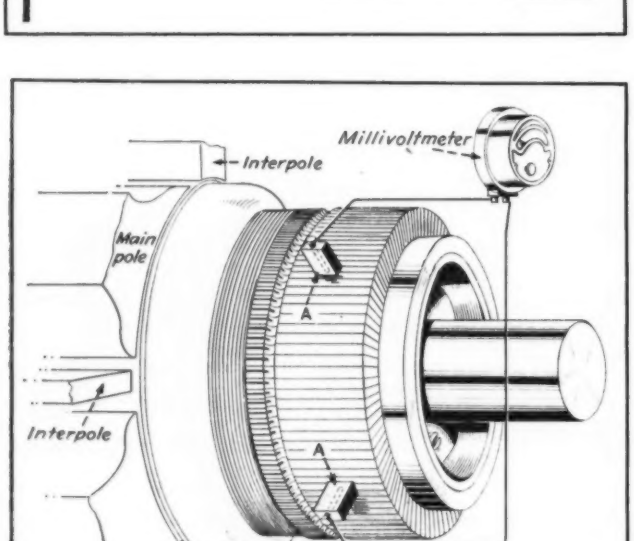
HOW TO SET INTERPOLE MACHINE BRUSHES

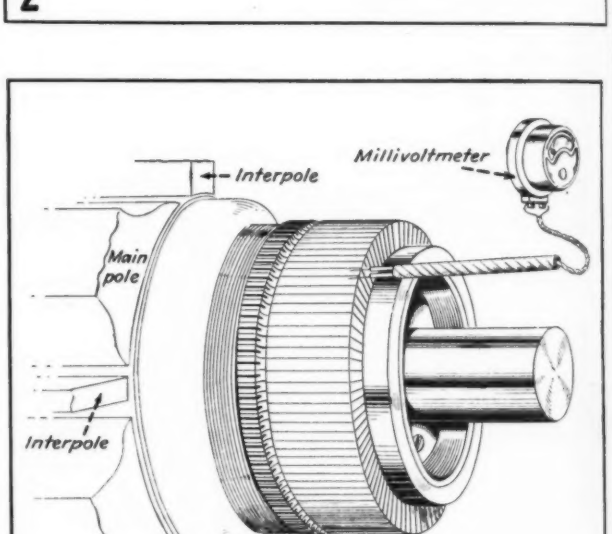
▶ ON DIRECT-CURRENT MACHINES fitted with interpoles, the neutral is sharply defined and brush position must be determined accurately. The manufacturer usually places the marking, but if it should be effaced during overhaul or when a change requires repositioning the brushes, there are a number of ways to relocate the position. Some are more accurate than others.

Before checking brush position inspect the machine both mechanically and electrically. Space the brushes equally around the commutator and see that they seat properly; measure clearance between brush holder and commutator and adjust if necessary. Tighten field connections.









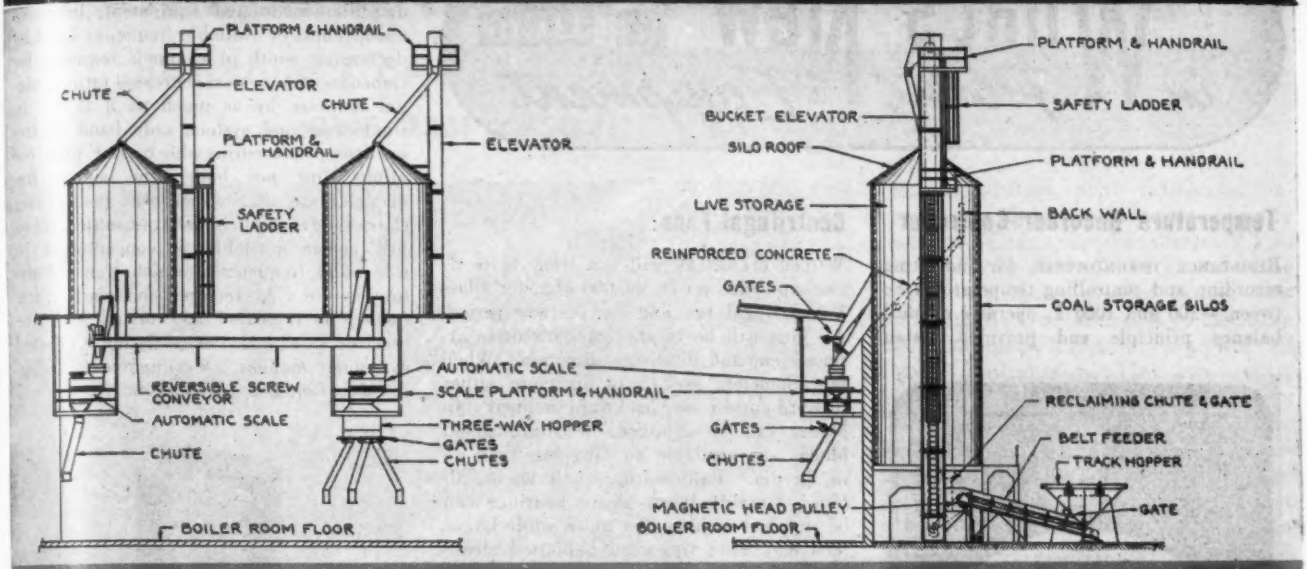
1 On a motor an approximate method is to open the shunt field *A*, close main switch and move starter handle to first notch. If armature tends to turn in one direction shift brushes in opposite direction. Find a position where armature remains stationary. On a compound motor cut the series winding out during test but leave interpole winding in series with armature.

2 When the armature coil top leads can be traced from the coil slots to commutator bars they indicate the approximate brush position. Move armature until one slot comes directly under interpole; then follow coil lead from this slot to commutator. Shift the brushes until the nearest one comes directly on the segment connecting to the coil lead. With more than one coil group in one slot, set the brush midway of the segment group.

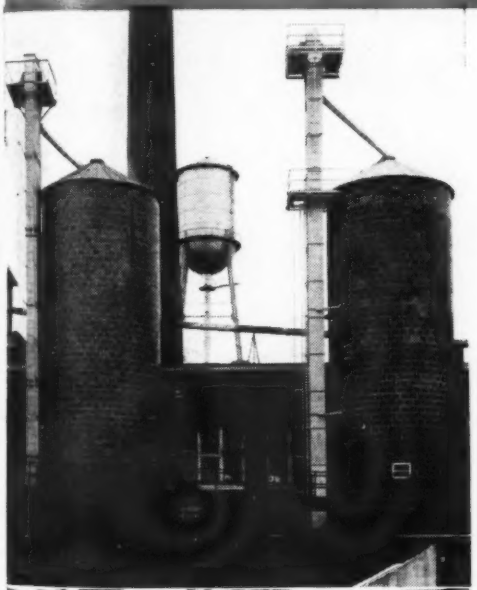
3 One accurate method is to connect a millivoltmeter to copper terminal pins centered in fiber brushes, inserted in two brush holders, one pole space apart. Set brushes in approximate neutral position. Energize the shunt field several seconds, then open switch slowly. Transformer action induces a voltage in the armature, but the millivoltmeter registers zero if brushes are in neutral position.

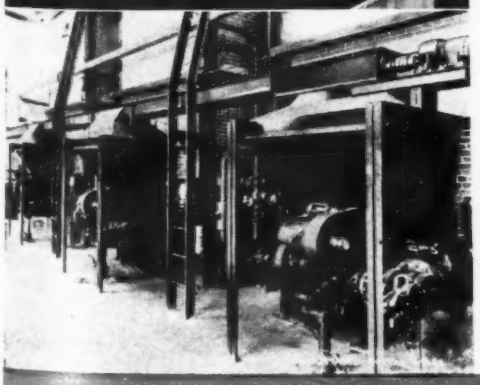
4 Most satisfactory method is to measure voltage drop between commutator segments in the neutral zone with a millivoltmeter while machine operates. Use either the double-prong probe shown or a fiber brush fitted with two copper or brass contact rods spaced to rest on two adjacent commutator bars. Zero reading on the millivoltmeter indicates neutral position. Machine can be carrying load or be unloaded.

Engineered to meet your specific need



FAIRFIELD *Coal and Ash Handling* SYSTEMS





● The coal handling system illustrated shows a twin silo installation with a combined capacity of 415 tons and the equipment will handle 30 tons an hour.

This system handles coal automatically from car to storage to pulverizer. It is arranged with a reversible screw conveyor so that coal can be taken from either silo and delivered to any pulverizer.

The silos are of circular design and made of 6" thick vitrified, salt glazed tile. They do not absorb moisture and provide effective insulation against freezing. Erected outside of your boiler room they do not interfere with present structures and eliminate dirt and dust in the boiler room.

Fairfield assumes full responsibility for the design—construction and erection of the entire system including conveying equipment—storage and distribution to pulverizers or stokers. In many instances the system also includes ash removal and storage.

Consult Fairfield on your conversion plans—plant extensions and new plant developments requiring coal and ash handling and storage. Our new catalog illustrates and describes many successful installations which were developed to meet the customers specific needs. *Write for your copy.*

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What's New in Plant Equipment

Temperature Recorder-Controller

RESISTANCE THERMOMETER, for indicating, recording and controlling temperatures between —100 and 1000 F, operates on null-balance principle and provides instantaneous balancing action by electronic detection and control. Unbalance of measuring bridge is detected by electron tubes without aid of galvanometer or other moving parts. *Bailey Meter Co,* 1050 *Ivanhoe Rd, Cleveland, Ohio.*

Welding Process

GALV-WELD PROCESS applies welding to design of an outdoor substation structure, instead of bolted construction utilizing galvanized steel members. Welded construction provides an outdoor substation structure that is more rigid, of better appearance and less expensive in first cost and maintenance expense. Galv-Weld process makes it feasible to regalvanize welded joints in galvanized structural steel, leaving entire welded structure rustproof and corrosionproof. *Galv-Weld Products,* 402 *E 2nd St, Dayton,* 10, *Ohio.*

Lubricating Agent

BONOLEUM IS AN INGREDIENT blended with all bonded oils as a high-film strengthening agent, impervious to chemicals, heat or acid. It is compounded with a castor-oil essence from which the gum-forming ingredients have been removed. *Bonoleum* is said to eliminate surface tension and assure a transparent, free-flowing lubricant. It is also claimed to prevent skin infection. *Bonded Oil System, Inc,* 108 *Massachusetts Ave, Boston* 15, *Mass.*

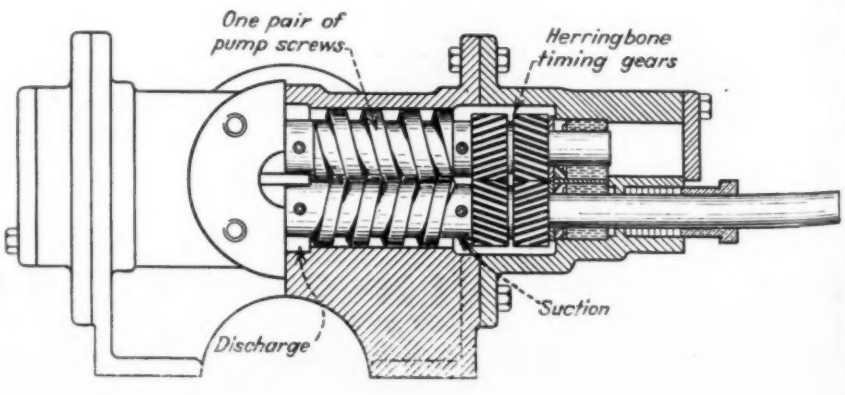
Centrifugal Fans

WHEEL DIAMETERS will run from 4½ to 89 in., capacities up to 330,000 cfm, for Class I centrifugal fan line for postwar period. All fans will be in any standard drive arrangement and discharge direction. When fan diameters are 15 in. or more either forward-curved or backward-inclined fan blades can be obtained. Forward-curved blades are available on fans less than 15 in. in dia. Ball bearings will be on all fans. Graphite-insert sleeve bearings can be supplied with smaller units, while larger fans may have ring-oiled babbitted sleeve bearings. Either single-width single-inlet or double-width double-inlet blowers may be specified. Line creates sizes and capacities for all requirements of heating, ventilating and air-conditioning fan applications. *Trane Co, La Crosse, Wis.*

Screw Pump

SIER-BATH SCREW PUMP discharges in a continuous flow without pressure pulsations through an axially progressive moving action of two screws on the fluid. Double pairs of screws mounted on two shafts take fluid from each end of pump body and move it toward center for discharge. This double pumping action puts pump in hydraulic balance and eliminates thrust bearings except in vertical pumps, in which anti-friction bearings support shafts and screws only. Pumping screws are timed by pair of herringbone gears, which do not permit side wear of screws by contact during pumping.

Driven by motor, pumps operate at 1200 rpm, and by steam turbine, at 1300 rpm. They are for following services: (1) fuel-oil firing in industrial and power plants (2) fuel-oil transfer and lubricating-oil service (3) house and sprinkler-water service (4) handling heavy viscose fluids, such as molasses, acetates and sirups. *Sier-Bath Gear Co, North Bergen, N. J.*



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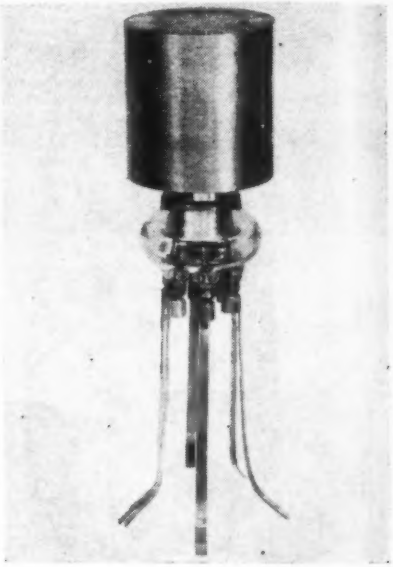
WESTINGHOUSE SYSTEM, added to standard amplitude-modulated equipment, increases effectiveness of available frequency band by decreasing width of channels required for transmission. System increases ratio of signal to noise by as much as 8 to 1. In single-side-band system, only band of frequencies representing the carrier plus (or minus, but not both) the signal frequencies are transmitted over power line. Carrier wave itself is not transmitted. Thus full power available is concentrated in side band frequencies, which transmit the intelligence. At receiver end, carrier frequency is recreated and mixed with the received side band. Demodulation is effected in regular manner. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*



Power Tube

F-5303 COMPACT POWER TUBE with 6-in. flexible copper leads permanently secured to tube terminals eliminates glass damage in attaching and adjusting terminal clamps on tube and permits installation and maintenance by inexperienced personnel. Other outstanding features are its sturdy, conservatively spaced filament and grid elements and an absence of ceramic insulation, both internal and external. These qualities make

(*Continued on page* 150)

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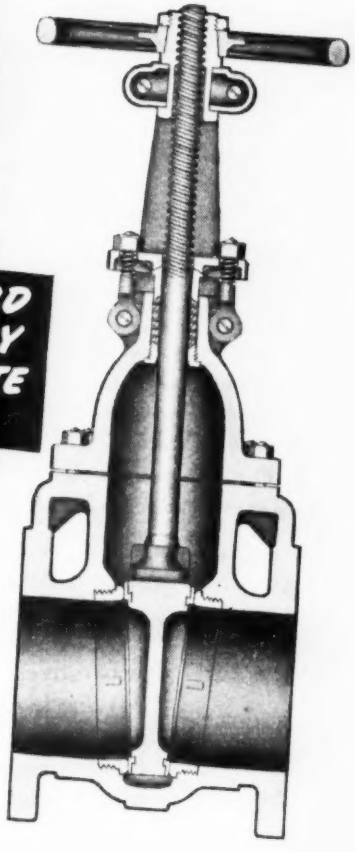

SERVICE RECOMMENDATIONS: **Crane Standard Iron Body Wedge Gate Valves** with brass trim are recommended for steam, water and oil lines; all-iron valves for oil, gas and fluids that corrode brass. Made in OS&Y and Non-Rising Stem patterns.

Working Pressures

Size of Valve	Screwed or Flanged Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil, or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

*For steam lines larger than 16-inch, Crane 150-pound Cast Steel Gate Valves are recommended.

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Power-Plant Pumps...

A poem may cloud, or may clarify
As it happens to hit your ear or eye.
This does a little of both, no doubt,
Tho' written in fourteen lumps,
To try and tell you all about
Our many power-plant pumps.

Big pumps and little pumps,
Tough pumps and brittle pumps,
Pumps to pump a river dry
Of everything that's in it—
Thirty thousand gallons
Every single minute.

New pumps and old pumps,
Hot pumps and cold pumps,
Single pumps and twin pumps,
Or dozens in a row,
It takes about a hundred pumps
To make a power plant go.

Gear pumps and screw pumps.
Too many, or too few pumps,
Pumps to pump the water in,
Pumps to pump it out,
Pumps we cannot live with
And cannot live without.

Air pumps and tire pumps,
Oil pumps and fire pumps,
Pumps to put a fire out
And pumps to make it burn,
Pumps that keep the vacuum up,
Which do not even turn.

Sewer pumps and sump pumps,
And some double-hump pumps.
Pumps of every nature
On which a plant depends,
Some are lying on their backs
Some standing on their ends.

Motor pumps and steam pumps,
Nightmare, or dream pumps,
Pumps that make a fearful noise
And run at awful speed,
We'd like to stop them if we could
But must have boiler feed.

Tall pumps and squatty pumps,
Nice pumps and naughty pumps,
Pumps that run without a care,
Pumps that raise the deuce
Pumps that should be tighter
And pumps that must be loose.

Deep-well and cistern pumps,
Drinking-water piston pumps,
Which must be bright and clean
To keep all germs away,
Or the Coca Cola slot machine
Will get an awful play.

Iron pumps and steel pumps,
Dummy packing seal pumps,
Pumps with one impeller,
Others that have six—
Where you must watch expansion,
Or are in an awful fix.

Rubber pumps and glass pumps,
Copper pumps and brass pumps.
Pumps with bronze impellers,
And with nickel shaft,
Double-suction pumps,
With packing fore and aft.

Cheerful pumps or sad pumps,
Good pumps and bad pumps,
Pumps that come from factories,
Where everything is fine,
Or others spawned in Hades
From the devil's own design.

Slow pumps and fast pumps,
First pumps and last pumps,
Pumps that run but seldom,
Pumps that run all day—
The latter fail by wearing out,
The former from decay.

Rhyming thumps, rhythm bumps,
Verbiage jumps and reason slumps,
All because I had to try
A card I thought was trumps,
To neither minimize, nor magnify
Our troubles with our pumps.

E W Earle, superintendent of Florida Power & Light Co, Dania, Fla., was moved to poetry by a recent McGraw-Hill pump-survey questionnaire. Mr Earle shows he knows the idiosyncrasies of pumps by this answer, in "a style I have never used before and probably never will again." Having battled pumps myself, I enjoyed Mr Earle's efforts, and thought that you might too.

George Edwards
Engineer

Because the yarn is Interlocked and braided square

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THE BRAIDING of the asbestos yarn in Johns-Manville Interlocked Rod Packing is done in a unique and exclusive way. Instead of braiding jacket over jacket, which unravels with wear, the long-fiber asbestos yarn is braided right into the body of the packing and securely interlocked to form a solid, integral structure. Naturally, this means longer packing life and fewer repacking jobs for you!

Furthermore, J-M Interlocked Rod Packing is braided square . . . not braided round and pressed square . . . resulting in a more flexible and resilient packing. This square-section structure presents a better contacting area and provides a tight seal with minimum gland pressure.

J-M Interlocked is now available in a variety of compositions to meet a wide range of operating conditions—such as Nos. 255 and 257 for use against saturated or superheated steam, hot or cold, fresh or salt water, oils and weak caustics or acids, No. 253 for paper stock pumps, No. 259 for gasoline service, and No. 270 for hot oil packing. For more details, write for catalog PK-12A. Johns-Manville, 22 East 40th Street, New York 16, N. Y.

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Rowley Made Managing Editor of POWER

Effective Jan 1, 1945, Louis N Rowley was appointed managing editor of POWER in recognition of his creative work as associate editor. Under general supervision of Editor Swain, he will coordinate the many engineering, journalistic and production operations involved in publication of POWER.

Born in Brooklyn—the only native New Yorker on the staff—Rowley is an honor mechanical engineering graduate of Brooklyn Polytechnic and holds a master's degree in business administration, New York University.

After early drafting-room experience he worked in several engineering capacities with Brooklyn Edison for six years before coming with POWER as assistant editor in 1937. For several years Rowley has been secretary of the ASME Oil and Gas Power Div.

Coal and Fuel Oil Outlook for Spring

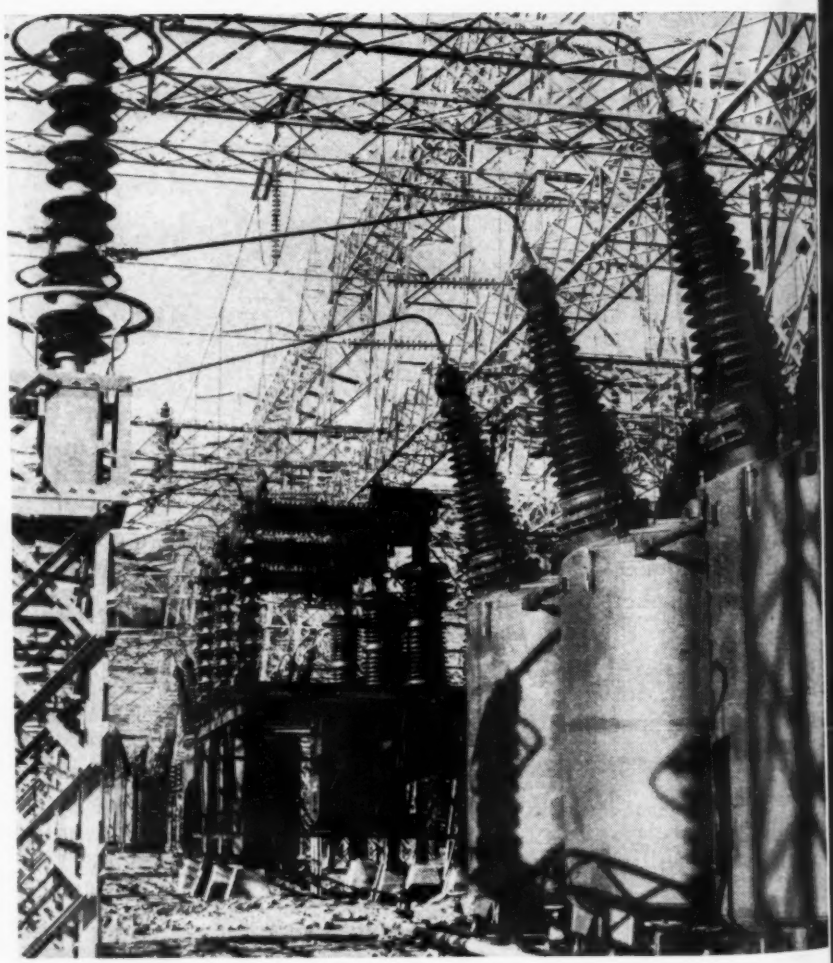
Supply for the coal year ending March 31, particularly of high-grade coals, is expected to draw down the national stockpile to slightly less than one month's requirements, although bituminous coal production in 1944 surpassed that of the previous year by almost 30,000,000 tons and came within a few million tons of meeting 1944 demands. Consumption for the coal year is expected to reach 626,000,000 tons and the deficit to range between 10,000,000 and 16,000,000 tons. Solid Fuels Administration said demands for increased war production would boost consumption during the coal year but foresaw no comparable increase in production.

Added to the precarious coal situation that will confront the nation next April 1 is the fact that the existing contract under which United Mine Workers is operating will expire then, which may result in repetition of the 1943 strikes. According to one optimistic government official, coal operators and UMW negotiators are already discussing a new contract and present indications are that there will be no work stoppage or one not exceeding two or three days.

Shortage of byproduct coals, most of which are mined in districts 7 and 8, had become sufficiently pressing for

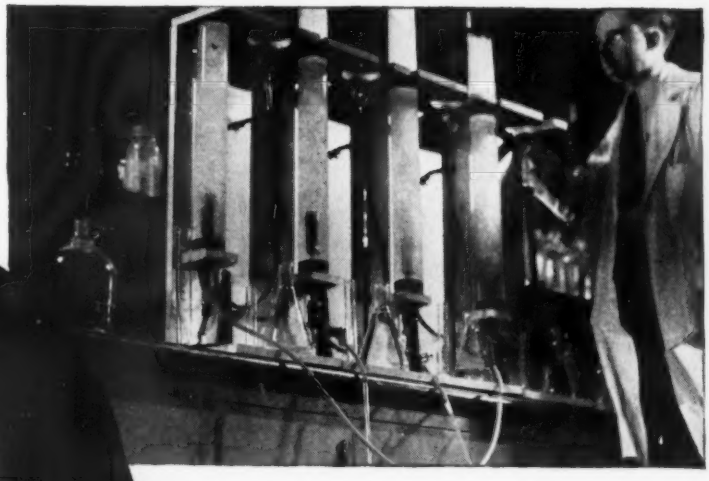
(*Continued on page* 182)

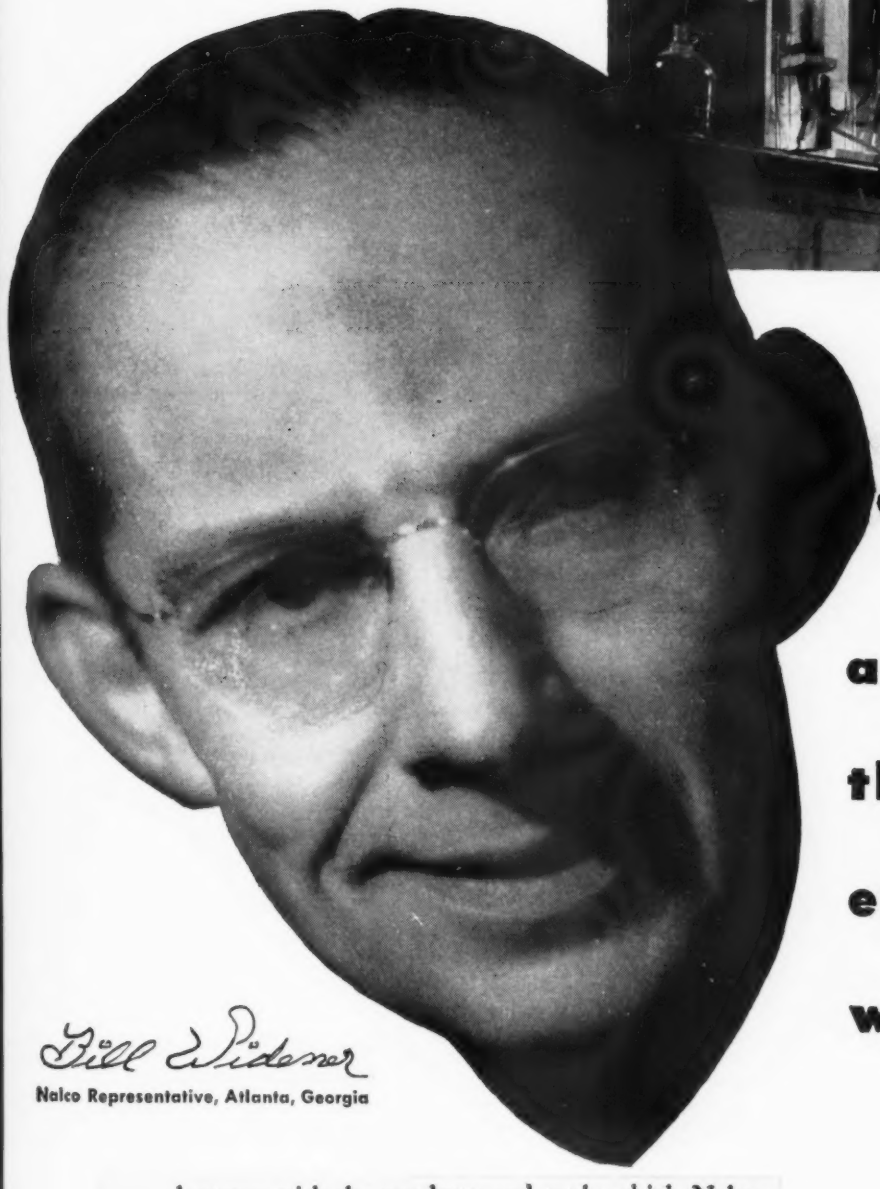
Impulse Breaker at Coulee Dam



Impulse oil circuit breaker in switchyard at Grand Coulee Dam, Wash., protects a feeder which serves an important war load in Pacific Northwest. It rates 3,500,000-kva interrupting capacity. In the foreground is an 800-amp 230,000-v tank-type oil-blast power circuit breaker, rated at 2,500,000-kva interrupting capacity, for switching and protection of a generator circuit. Tank breaker requires about ten times the oil used for impulse breaker

Photo in Nalco Laboratories





Bill Widener
Nalco Representative, Atlanta, Georgia

"Yes, Joe... a Nalco man thoroughly enjoys his work"*

. . . . because with the products and tools which Nalco furnishes, it is a pleasure to help you obtain the efficiency and smooth operation that the Nalco system of water treatment provides.

Looking at it from your viewpoint, Joe, this feeling and enthusiasm on the part of Nalco representatives (together with Nalco products and services) can help you prevent scale, corrosion, foaming and algae in your plant and banish a dozen other headaches that go hand in hand with untreated water. Let us show you what we mean when we say *"Nalco—the complete water treating service"* . . . . call a Nalco representative today.

* JOE . . . . *a master mechanic in a large industrial plant, an operating engineer at a utility station, a chief engineer or a power plant engineer in any industry who is eager to eliminate the troubles caused by improperly treated water.*

NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago 38, Illinois

Nalco
THE COMPLETE WATER TREATING SERVICE

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

INTRODUCED ONE YEAR AGO

Jenkins

JENKINS ANNOUNCES NEW LINE OF *Air Furnace* MALLEABLE IRON VALVES

USES SAME TOUGH, SHOCK-RESISTANT METAL THAT MAKES U. S. WAR EQUIPMENT FAMED FOR ABILITY TO STAND ROUGHEST DUTY

COMPARE	TENSILE STRENGTH	SHOCK RESISTANCE		TEMP-ERATURE LIMIT	CORROSION RESISTANCE (Relative)
		YIELD POINT	ELONGATION IN 2 INCHES		
ASTM 126-30 CAST IRON	34,000 LBS. PER SQ. IN.	0	0	TO 450°F	
ASTM 47-33 AIR FURN. MALL. GRADE 35018	53,000 LBS. PER SQ. IN.	35,000 LBS. PER SQ. IN.	18%	TO 450°F	
ASTM 95-36 CARBON STEEL	70,000 LBS. PER SQ. IN.	36,000 LBS. PER SQ. IN.	22%	TO 750°F	

APPROVED and USED TODAY in these important industries...

Petroleum • Metal and Coal Mining Chemical • Paper • Synthetic Rubber Food • Cement • Process Industries Power Plants • Marine • and many other fields where valves are subjected to unusual strains and destructive service conditions such as those described below.

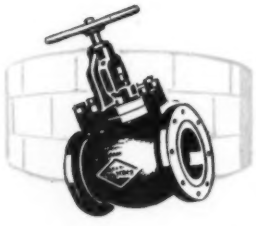
ONLY AIR FURNACE MALLEABLE MEASURES UP TO THE PROPERTIES SHOWN IN THIS CHART

Don't confuse *Air Furnace* Malleable with other types of malleable iron. Top-rated grade is Air Furnace Standard Specification ASTM-47-33, Grade No. 35018 . . . the type used by Jenkins!

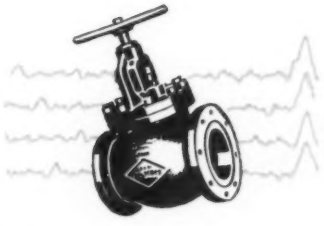
MEET U. S. STANDARDS – Jenkins Air Furnace Malleable Iron Valves meet the standards of the United States Maritime Commission, and the Bureau of Marine Inspection and Navigation, United States Coast Guard.

HERE'S WHERE THESE VALVES CAN SAVE FOR YOU!

WHERE external fire hazards threaten valves with abnormal heating and sudden cooling that might crack other valves.



WHERE conduction of hazardous liquids or gases, as in petroleum or chemical services, requires valves of exceptional toughness.



WHERE vibration, shock, or water hammer, individually or in combination, would break valves made of other metals.

JENKINS VALVES

SINCE 1864

Pioneering

PROVIDES A MUCH-NEEDED NEW VALVE FOR WAR BURDENED INDUSTRY

Fig. 1105
Bronze Mounted Globe

Fig. 1101
Inside Screw,
Bronze Mounted Gate

Leading again in the drive for greater valve economy, Jenkins introduced the *Air Furnace* Malleable Iron Valve over a year ago.

Developed for certain "tough spots" where shock and strain run up abnormally high repair and replacement costs, these new valves have provided savings well beyond original estimates in many industries. By lasting longer, and requiring less attention, they help materially to conserve valves, and spread scarce maintenance man-hours further.

Proved under rigorous wartime plant conditions, Jenkins *Air Furnace* Malleable Iron Valves will fit well into your plans for new savings in post-war plant operations.

Next time you order valves for use *where steam pressure does not exceed 150 lbs., and where temperature is not above 450° F.*, check service conditions closely. If the valves must "take a beating", for any of the reasons listed below, consider Jenkins *Air Furnace* Malleable Iron Valves. There's a good chance they'll serve best and save most.

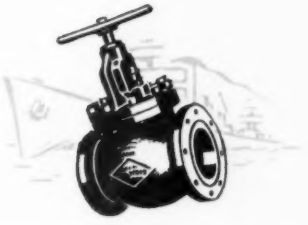
WRITE FOR BULLETIN NO. 192 describing this complete line, in many patterns, sizes 2 in. to 6 in. Write to Jenkins Bros., 80 White Street, New York 13, N. Y.

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago. Jenkins Bros., Ltd., Montreal; London.

Check your services for Tough spots like These!

WHERE the higher corrosion resistance of *Air Furnace* Malleable is essential, as in mine, chemical, marine, petroleum and similar services.

WHERE valves are subjected to freezing, or sudden and extreme variations of temperature are a condition of service.



WHERE valves are exposed to destructive atmospheric conditions, such as salt air or corrosive fumes from acids or chemical solutions.

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

BRONZE · IRON · STEEL

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

POWER'S DATA SHEETS

Number 150

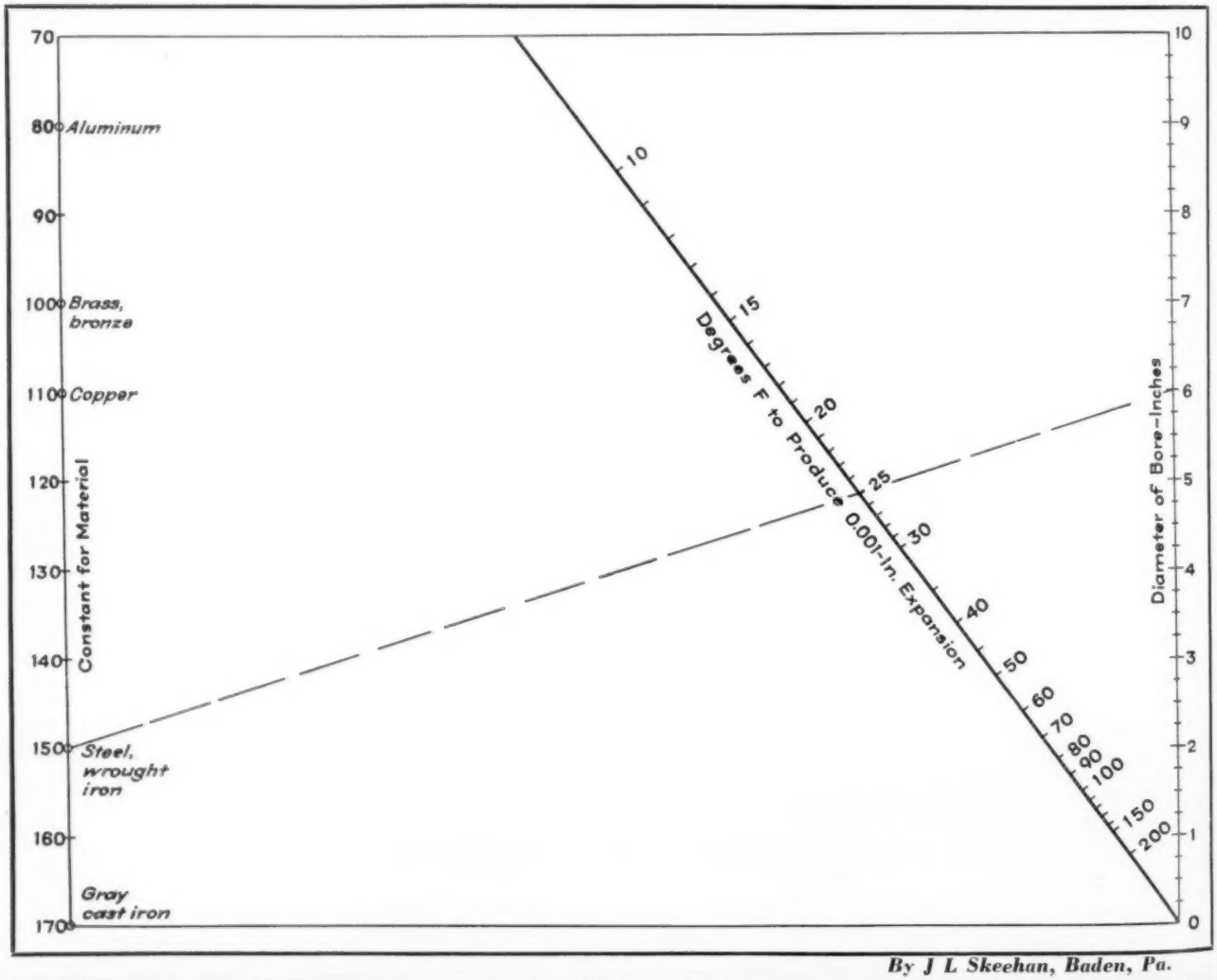
Shrink-Fit Temperature Chart

► TEMPERATURE to which a ring must be heated for shrink fit can be determined directly from the chart below, which gives the number of degrees Fahrenheit necessary to produce 0.001-in. expansion of the bore. A 6-in. steel hub, for example, requires 25 F heating for each one-thousandth inch increase in diameter.

Coefficient of expansion for steel, for instance, is 1:150,000 per deg F, or 1/1000 increase in any dimension for a temperature rise of 150 F. Corresponding values for other metals are given in next-to-last column of the table and indicated on the chart.

Holding power of shrink fits can be calculated from the last column of the table which gives stress produced in bore and shaft for each deg-F shrink beyond exact fit. Values for expansion and stress are good only within a limited temperature range but may be safely used for general practice.

Material	*Modulus of elasticity, millions psi*	*Coefficient of expansion, decimal*	*Coefficient of expansion, fraction*	*Deg F per 0.001 in.*	*Stress, psi per deg F*
Steel Wrought iron	30	0.0000067	1/150,000	150	200
Aluminum	11	0.0000128	1/80,000	80	140
Copper, cast	10	0.0000093	1/110,000	110	90
hard drawn	18	———	———	—	160
annealed	15	———	———	—	135
Brass Bronze	10	0.0000101	1/100,000	100	100
Gray cast iron	12	0.0000059	1/170,000	170	70



By J L Skeehan, Baden, Pa.

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ONLY *Flowmatic* OFFERS ALL THESE ADVANTAGES

Performance records confirm the Copes Flowmatic Regulator as the outstanding development in Boiler Feed Water Control.

Here's why--

1. Copes Flowmatic varies the rate of feed in proportion to changes in steam flow, with secondary compensation from boiler water level.
2. Maintains boiler water level within extremely close limits—minimizes effect of "shrink" and "swell."
3. Eliminates danger of burned tubes due to low level, or carry-over due to high level.
4. Flowmatic saves fuel—decreases maintenance. Instant and correct response to every demand provides optimum feed conditions for boilers, economizers, heaters and pumps.
5. Increases boiler capacity; gives more uniform steam pressures.
6. Reduces tendency to swap loads among boilers of a battery.
7. Copes Flowmatic usually eliminates the necessity of differential pressure control.
8. Lower first cost and maintenance than other systems for similar service.
9. Can be installed, adjusted, and cut into service by plant personnel. Not dependent on factory specialists.
10. Adjustable for any desired water level characteristic—falling, constant, or rising with load.
11. Flowmatic is fully automatic and is independent of other control systems.
12. Thoroughly dependable, built for continued hard usage with no more than routine care and inspection.
13. Available in both direct operated and relay operated types.
14. Flowmatic is a Copes Product—symbol of pioneering and leadership in feed water regulation.

Read the interesting 5-year performance record of Copes Flowmatic, summarized in the folder "No Two Boilers Are Alike." Furnished free, together with descriptive catalog, upon request for Bulletin 429A.

NORTHERN EQUIPMENT COMPANY
251 GROVE DRIVE • ERIE, PA.

Feed Water Regulators • Pump Governors • Liquid Level Controls • Differential Valves • Reducing Valves and Desuperheaters

Branch Plants in Canada, England — Representatives Everywhere

★ **GET CLOSER LEVEL CONTROL WITH THE FLOWMATIC** ★ REGULATOR

STICKLE *Cuts Costs* OF STEAM FOR INDUSTRIES AND INSTITUTIONS . . .

Plants in many lines of industry using steam for processing operations—such as evaporating, drying, pressing, shaping, finishing—are each doing better work in greater volume at less cost with the use of Stickle Equipment or complete Stickle Systems. Through proper control of steam pressures and proper drainage of condensate, they obtain a production effectiveness close to the potential capacity of their units. By salvaging exhaust steam for heating make-up water and returning condensate, under pressure, to boilers directly from processing units, they obtain an ultimate low in steam generating costs.

STICKLE OPEN COIL HEATERS AND PURIFIERS save fuel and increase boiler capacity. Sizes to meet capacity requirements, deaerating or non-deaerating types, in cast iron or steel construction. You'll be interested in their *plus* advantages. . . .

Read Stickle Bulletin No. 117.

STICKLE DIFFERENTIAL DRAINAGE AND BOILER RETURN SYSTEM eliminates B.T.U. loss in condensate. A closed system, pumping condensate into boilers, under pressure, at a temperature only slightly lower than steam at operating pressure. Its distinct practicability and utility will appeal to you.

Read Stickle Bulletin No. 250.

STICKLE REGULATING AND REDUCING VALVES supply the positive control essential for efficient operation. In single-seated and double-seated series, small to large sizes, standard types of construction.

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STICKLE OPEN FLOAT STEAM TRAPS, effective in results, trouble-free in operation, in four design series for desired application and service requirements. There are many reasons why Stickle Traps will win your approval, too.

Read Stickle Bulletins Nos. 115, 315, 415 and 515.

● Works managers, plant superintendents, engineers and others interested in more efficient production and lower cost operations are invited to write for Stickle Bulletins.

ALL TYPES OF INDUSTRIES AND INSTITUTIONS using steam for processing operations or for heating, including those in the

PULP AND PAPER INDUSTRY . . . Pulp Manufacturers, Paper Mills (newsprint, book, writings, kraft) Paper Board Mills, Corrugated Paper Plants;

FOOD INDUSTRY . . . Canneries, Milk Drying Plants, Packers of Fruit and Vegetable Products, Preservers and Other Food Processors;

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Lumber Industry . . .

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Schools, Public Buildings, Hospitals, Hotels . . .

Wherever there is necessity for proper control of steam pressures or proper drainage of condensate to obtain better production or more satisfactory heating, Stickle Equipment—properly selected and properly adapted—will achieve the desired results.

ARMY E NAVY

Specializing for more than 40 Years in Reducing the Cost of Steam.

Stickle

STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA

Reader's Problems

(*Continued from page* 113)

operation is entirely inadequate for removing slag unless it is backed up by an exceptionally large air receiver. The large volume of air needed for removing slag that flows from a normal-sized receiver connected to a fairly small compressor, soon reduces the pressure to such a low value that the issuing air has little effect on the slag. HAS can use water to remove slag if he applies it carefully but best solution appears to be increasing air-compressor capacity, together with installing a distribution system large enough to supply large volumes of air for short periods.

New York, N. Y. L C RINEHART

Advises Against Water

WATER or a water-and-air combination for lancing tubes is not advisable because it may damage tubes and refractory. I suggest HAS use steam. Any pressure between 125 and 200 psi will do.

Use of steam will minimize wear on boiler tubes and refractories. Tell the boiler operators to lance the tubes at least once every shift (eight hours). Lancing may have to be done more frequently if the coal varies in ash content. Existing clinkers can, if not too large or hard, be chopped up with a breaking bar while the boiler is in operation.

Brooklyn, N. Y. A J WENIG

Make Several Nozzles

I SUGGEST that HAS use water to lance waterwall and roof-screen tubes in his boilers. I have used water for this purpose with considerable success.

A half-inch pipe is large enough and still not too heavy to handle and insert through inspection doors or wherever necessary to properly reach the slag. It is advisable to reduce pipe on the nozzle end to one quarter or even one eighth inch. This small nozzle can be shaped to do the job best. More than one nozzle can be made if need be, each bent differently to better reach inaccessible places around the tubes. Length of the half-inch pipe will have to be determined by experiment. The opposite end will of course be fitted with standard hose connection.

Use extreme care when lancing to prevent any great amount of water coming into contact with refractory or damage to the latter will result. It is also good policy to keep the water stream moving; in other words do not play the

THE BURNER that makes a new Boiler EASIER TO BUY

Thorough, accurate mixing of fuel and air . . . complete combustion . . . with Coppus-Dennis FANMIX

When planning new gas or oil fired boilers, you can count on investing less in boiler, stack and auxiliary equipment — if you select a Coppus-Dennis FANMIX Burner. Coppus equipment was used for instance in 93% of 191 petroleum refinery plants built for war use.

FANMIX Saves Combustion Space

FANMIX delivers to the furnace a homogeneous mixture of fuel and air, without blow-torch action. Combustion is rapid and complete — so smaller combustion space is needed than when the furnace must serve as mixing chamber as well — or ratings of present equipment can be increased.

FANMIX Creates Own Forced Draft

Less furnace draft is needed than with any other burner, because FANMIX creates its own forced draft, thus overcoming draft loss across the burner (at any operating range). Less stack is needed, and forced draft equipment can be eliminated entirely.

There are two FANMIX types — one to handle natural gas, the other a combination type to burn either gas or oil in entirety or gas and oil in any proportion. (No oil guns needed).

Coppus engineers FANMIX Burners for individual applications. Complete control over rate of combustion or "flame pattern" can be provided to meet the requirements of any installation. Coppus Engineering Corporation, 162 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

New Bulletin Will Help You When Installing New Equipment or Modernizing Old

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

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Please send Bulletin 410-4 to

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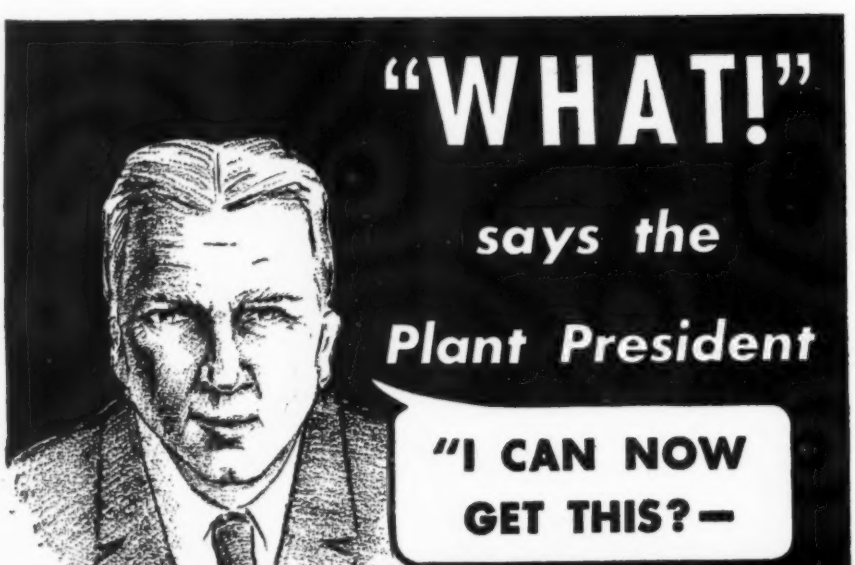
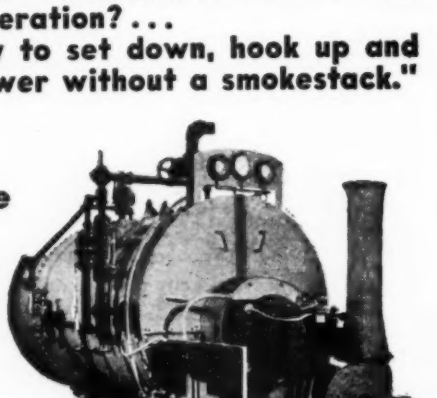


A complete, self-contained modern steam plant? . . .
One with overall efficiency stepped up to 80% or more? . . .
One that's oil-fired — has induced draft and 100% automatic operation? . . .
Dependable? Ready to set down, hook up and start producing power without a smokestack."

Sure! You can get all these advantages in the new, compact, complete



PREFERRED
UNIT STEAM GENERATOR

Gives you oil burner, induced draft fan, boiler, controls, piping, wiring, all perfectly co-ordinated into one unit. Saves boiler room space. Needs no stack. Capacities, 20 to 500 H.P. All you need is a priority to order one now for early delivery. Send coupon for full information.

— — — — — — — — — SIGN AND MAIL NOW — — — — — — — — —

Preferred Utilities Manufacturing Corporation
1860 Broadway, New York 23, N. Y.

☐ BULLETIN 1000—Full details on the Preferred Unit Steam Generator
☐ "DIVIDENDS FROM YOUR POWER PLANT"—the booklet that operating engineers in need of new boiler room equipment all want the management to read

Name.....

Address.....

P-2-45

PREFERRED UTILITIES

water in one particular spot too long.

Service water at 125 psi is satisfactory for this service; after some experimenting HAS will be able to remove the slag with a minimum of labor and time.

West Duluth, Minn. E R WEBBER

Suggests Saturated Steam

SUCCESSFUL SLAG LANCING depends upon furnace temperature, rate at which slag is deposited, its position relative to the area of greatest heat concentration and its composition, that is, the kind of ash and amount of carbon fused with it. Some slags blow best when completely molten, others when solid enough to spall under the cooling jet of air, water or steam. The former should be lanced at highest furnace temperature, the second at lighter loads when less heat is being released.

Since HAS has saturated steam at suitable pressure it is hard to understand why he should use any one of the three methods of lancing he seeks advice on. Saturated steam wet enough to contain water after expanding to the reduced pressure can be effectively used for lancing fused ash, although its use on flyash is unsatisfactory. Evaporation of water inside the lance draws enough heat to keep it cool and rigid. Water left in the steam helps crumble the chilling slag without undue damage to refractory.

Marissa, Ill. GEORGE HOLMAN

Power Plant Travels

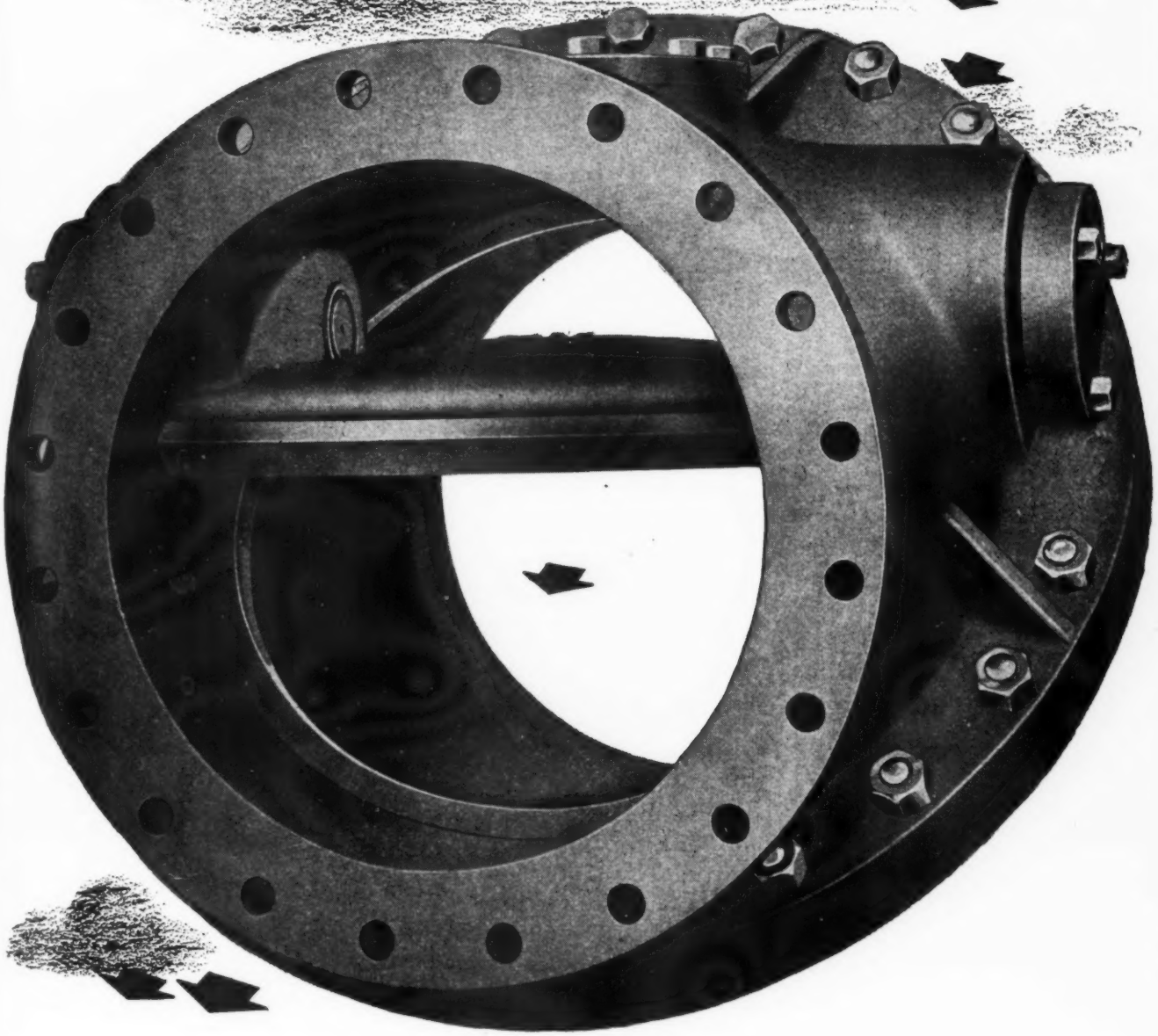
(*Continued from page 99*)

per regions and the rocket eventually reaches a height of over 60 miles above the earth's surface and comes down still following the parabolic path a shell would take.

Rockets being fired against England at present (January) have a range of about 200 miles and a total flight time from launching to impact on the ground of about five minutes. Speed is thus much greater than that of sound so that noise of V-2's passage is not heard until after it explodes. Its approach is frequently heard after the explosion as a rumbling sound like thunder, but the exact effect varies according to the observer's distance and position in relation to point of impact.

As it descends through the atmosphere from a height of 60 miles, air resistance slows V-2 down considerably and friction heats it to such an extent

AIRFOIL DESIGN means



CUSHIONED CLOSING

No slamming, no hammering, no surging on lines. Reduction of flow starts the disc closing until it comes down silently to a drop-tight seat.

REDUCED HEAD LOSS over conventional type checks, by 60 to 80%. Hinge pinned disc "rides" the flow with minimum resistance.

LONGER LIFE

. . . for both check valves and pipe lines!

WRITE US for the 12-page booklet giving full engineering data, test results and installation information on Chapman's Non-Slam Check Valves. The Chapman Valve Manufacturing Co., Indian Orchard, Mass.

CHAPMAN NON-SLAM CUSHIONED CLOSING CHECK VALVES

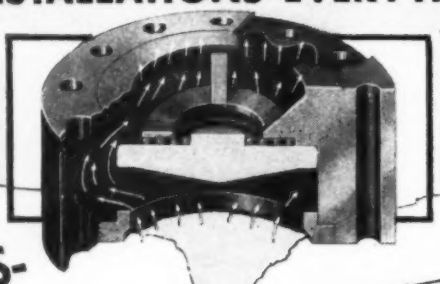
Available in Iron or Steel

Equally efficient on horizontal or vertical installations on water, steam, oil, gas and air lines

Preventing . . .

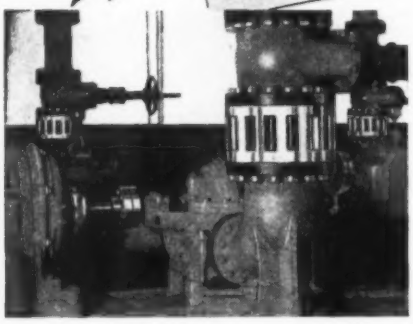
COSTLY, DESTRUCTIVE "WATER HAMMER"

WITH INSTALLATIONS EVERYWHERE!



WILLIAMS-HAGER

FLANGED *Silent* CHECK VALVES



Three 10"-300 lb. Williams-Hager Flanged Silent Check Valves in Radio City, N. Y.

Eliminates

Costly Breakdowns in Pumps and Piping Systems with Operating Pressures up to 6000 lbs!

Williams-Hager Flanged Silent Check Valves completely eliminate "Hammer" and "Bang" in the lines, provides uninterrupted constant flow of liquids.

Unlimited in size or application, from 1" to 20", built of materials to best suit the end use, Williams-Hager Flanged Silent Check Valves have been chosen for years as standard equipment in such exacting line uses as oil, gasoline, acids, water, chemicals, gas, salt water, brine, etc., etc., regardless of temperature.

Write today for interesting folder on "Water Hammer—Cause, Effect and Control in Piping Systems."

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

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that it has actually been observed glowing dull red.

Weight of explosive in V-1 and V-2 is about the same, and amount of damage caused is generally the same. The V-2, because of its terrific speed at impact, penetrates deeply and the blast area is thus smaller than that of V-1. Nature of the damage is thus somewhat different.

Although design and construction of V-2 undoubtedly represent a considerable technical achievement, the weapon's military value at present seems extremely doubtful. There is some evidence that the Germans were forced to use the V-2 before it was fully developed and thus present accuracy is not great. The Allies keep secret the places where V-2's land so that the enemy cannot correct aiming errors either by altering the adjustment of the instruments in the rocket or by other necessary modifications.

Armature Insulation

(*Continued from page* 102)

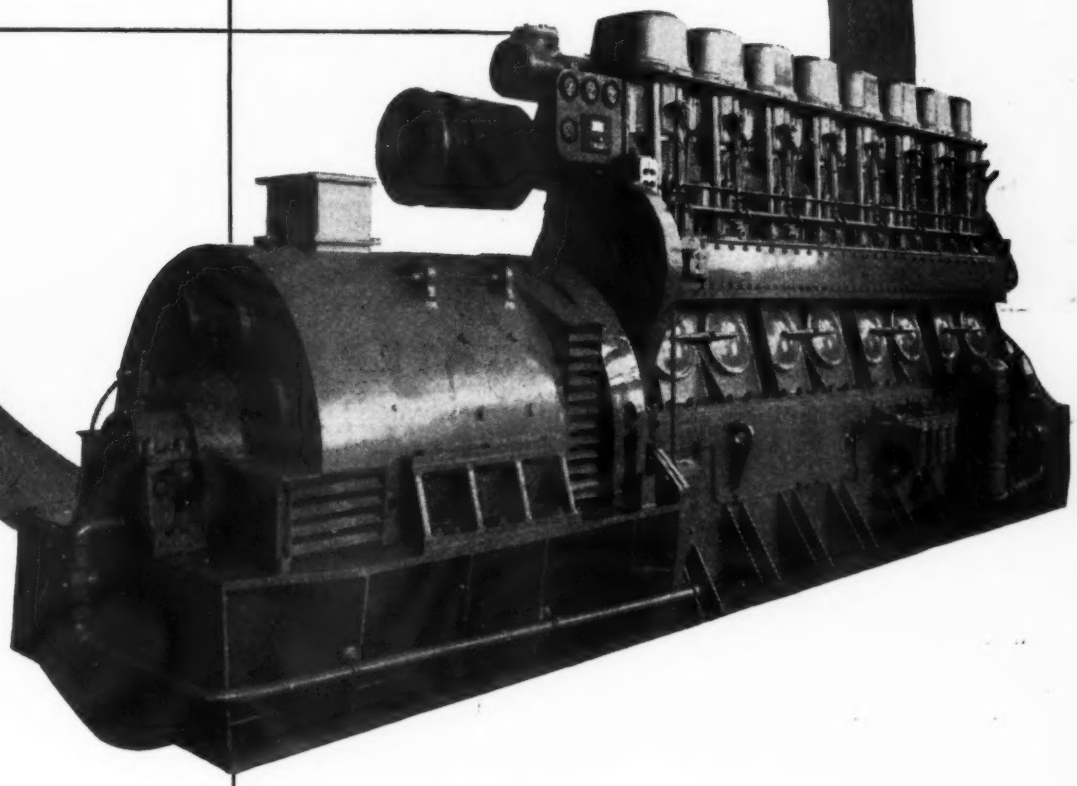
either by dipping it in a solvent or by pouring the solvent through the coil openings, and then thoroughly drying it in an oven or by external heat directed over the coils. If insulation resistance is still low, the cleaning and drying cycle is repeated to bring resistance back to normal. This cleaning and drying cycle may take considerable time if it has to be repeated several times before improvement is noted.

Conductive dirt is usually on certain areas of insulation, or it may even be concentrated at a spot on the armature coil surfaces or on the rear commutator V-ring. A carbonized path to ground as a result of flashover may also cause low insulation resistance. If it is possible to first probe for and locate the area or spot causing low resistance, cleaning will be simplified. You can then clean this area without blindly repeating cleaning and drying cycles of the entire armature.

First blow out all loose dirt with compressed air at not more than 50-psi pressure. Too high air pressure may damage the insulation. Measure creepage insulation resistance to ground on the rear commutator V-ring and on the inner surface of the armature coils behind the commutator necks and equalizer connections. Do this with a thin, round, insulated brass or copper rod, small enough to enter freely between

BALDWIN diesel engine

capacities from....
150 to 1,050 horsepower



Something new has been added to diesel engine cylinder liners—a new process to lengthen cylinder liner life and give the engine greater reliability—more hours of continuous operation.

Chrome-plate, applied to cylinder liner bores, multiplies liner life 4 to 20 times, ring life 3 to 5 times, and reduces the risk of piston seizure.

All this adds up to more satisfactory service and lower maintenance cost for your Baldwin diesel.

Baldwin 4-cycle diesel engines are serving railroad, marine, pipe line, power house and other industrial installations—capacities from 150 to 1,050 horsepower.

The Baldwin Locomotive Works, Locomotive & Ordnance Division, Philadelphia, Pennsylvania, U.S.A. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Houston.

BLW THE BALDWIN GROUP **BALDWIN**
DIESEL ENGINES

THIS DUGAS SCREEN

SHIELDS FIRE-FIGHTERS

● Dense clouds of fire-killing dry chemical create a real "heat-shielding screen" for the operator whenever a DUGAS Fire Extinguisher, charged with PLUS-FIFTY DUGAS Dry Chemical, is used to beat down a blaze.

All DUGAS Fire Extinguishers—large and small—are designed with fire-fighter protection as well as fire-fighting effectiveness in mind—a big reason why workers who may have to be fire-fighters feel more confident when they see DUGAS equipment close at hand.

Non-toxic, non-corrosive and non-abrasive. Approved by Underwriters' Laboratories and Factory Mutual Laboratories.

DUGAS 15-T HAND EXTINGUISHER

DUGAS 150 WHEELED EXTINGUISHER

ANSUL CHEMICAL COMPANY, MARINETTE, WISCONSIN
DUGAS DIVISION

the armature coils behind the commutator risers.

A ⅛- or ¼-in. rod insulated with spaghetti tubing will do. Connect one end of it to one terminal of a hand or motor-driven Megger, Fig. 2, and the other Megger terminal to the armature shaft or any convenient ground on the armature. A hand or motor-driven Megger is preferable as most electronic devices for this purpose are not calibrated below 80,000 ohms. With a hand Megger one person should handle the insulated probe while the other cranks the Megger and takes readings.

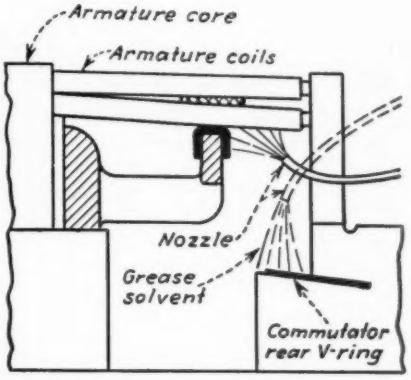


Fig. 4—Cleaning armature coils and V-ring by spraying with grease solvent

Insert the probe between coil ends behind the commutator risers until its bare end rests on the commutator's V-ring. Mark the armature at this point to indicate the start. Slowly sweep the probe's end across as much of the V-ring periphery as space between coils will permit, as in Fig. 2. Record insulation-resistance values. Now move probe over several coils just far enough so that the arc of its sweep will slightly overlap that of the previous tests as shown in *A-A*. Repeat this process until the commutator V-ring periphery has been covered and insulation creepage resistance measured. Note any wide variations in insulation resistance from one area to another.

If one or more spots have considerably lower insulation resistance than others, mark them. Make similar tests on the armature-coil inner surfaces back of the commutator risers, and also back of the equalizer connections, Fig. 3. Note insulation creepage resistance for the entire periphery under the armature coils.

When the armature's condition has been determined by locating unhealthy areas, corrections can be made. For example, if creepage-insulation resistance under armature coils behind the commutator risers is consistently low and that on the commutator rear V-ring

Stop Wear, Rust and Corrosion with this

BODY-GUARD FOR A BALL BEARING!

THROUGHOUT your busy plant, there are hundreds, perhaps thousands, of grease-lubricated ball bearings like the one shown at the right.

As you know, their efficient operation depends largely upon a grease that continuously covers the highly polished surfaces and provides strong films for protection against wear, rust and corrosion. At the same time, this lubricant must seal out impurities, minimize leakage, make frequent re-packings unnecessary.

Today, in thousands of U. S. plants, Gargoyle Greases BRB, are providing this maximum protection. They are outstanding for their stable structure and their resistance to oxidation and separation over long periods in service.

Get Gargoyle Greases BRB, and be sure your ball bearings have the best body-guards you can buy.

SOCONY-VACUUM OIL CO., INC.
Standard Oil of N.Y. Div. · White Star Div. · Lubrite Div. · Chicago Div. · White Eagle Div. · Wadhams Div. · Magnolia Petroleum Co. · General Petroleum Corp. of Calif.

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GARGOYLE Lubricants

Socony-Vacuum's 5 STEPS to Lower Production Costs for You!

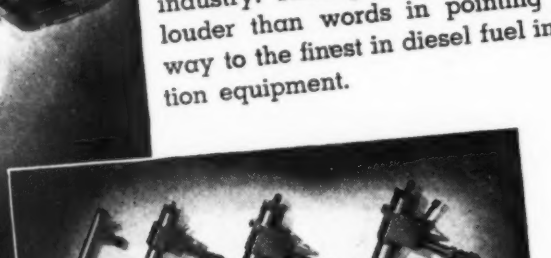
1. Lubrication Study of Your Entire Plant
2. Lubrication Schedules and Controls
3. Lubricant Storage and Handling System
4. Skilled Engineering Counsel
5. Progress Reports of Benefits Secured

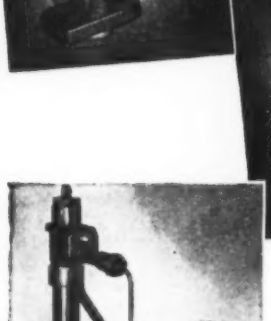
SAFEGUARD DIESEL ENGINE PERFORMANCE

with Dependable ADECO

FUEL INJECTION EQUIPMENT

Adeco equipment is engineered to secure the optimum performance of the engine you are building or plan to build. Today's line of fuel injection pumps, nozzles and nozzle holders is the most dependable in Adeco history—the result of years of pioneering and research for the diesel industry. Their performance speaks louder than words in pointing the way to the finest in diesel fuel injection equipment.





ADECO NOZZLE TESTER for LOW-COST MAINTENANCE

America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Also obtainable with Navy-approved gauge. Write for bulletin.

Ideal for Testing Hydraulic Equipment

ADECO

AIRCRAFT & DIESEL EQUIPMENT CORPORATION

4401 RAVENSWOOD AVENUE, CHICAGO 40, ILLINOIS

and under the coils behind the equalizer connections is consistently high, then concentrate most cleaning effort on the low-insulation-resistance area.

Clean inner armature-coil surfaces and commutator rear V-ring by spraying on a good grease solvent. Spray with a small nozzle inserted between the commutator risers or between the armature coils behind these risers, Fig. 4. After thoroughly washing with solvent, dry the armature and measure its insulation resistance. If the reading is still low, repeat the process, concentrating on the areas that have low insulation-creepage resistance until insulation resistance approaches a safe value. Then dry the armature at approximately 100 C for several hours.

After drying, spray the inner surfaces of the armature coils and the commutator rear V-ring with one or more coats of good air-drying insulating varnish. Apply it with the same nozzle used for cleaning solvent.

If creepage-insulation resistance is consistently high under the armature coils at both front and rear and also on the commutator rear V-ring, but armature total insulation resistance is low, the trouble is somewhere else in the armature. Cleaning under these circumstances may improve this condition only temporarily or perhaps not at all. Cause of the trouble may be either damaged or defective insulation or a grounded coil in a slot. Armature must then be taken out of service, stripped and rewound with new coils and with new insulation.

Your Refrigerating Job

(*Continued from page* 76)

0.301% and for combination superheating the gain is 1 + 0.301 or 1.301%, instead of 2%. In a large compressor, capacity loss from handling superheated gas may offset the gain introduced by useful superheating. However, it may be worthwhile on small machines. Any net gain in tonnage capacity derived from suction-gas superheating reduces the brake horsepower per ton ratio because total brake horsepower remains comparatively constant.

In addition to operating economy, these practical reasons call for an interchanger in the circuit.

1. A cold suction line, unless insulated, is prone to sweat. A heat exchanger raises the suction temperature above the ambient-air dewpoint enough

Rough turns slow the flow

CONSIDER how the wild mountain stream twists and turns, uses up energy cutting away at banks and boulders, fighting obstructions that impede its smooth flow. Smooth, efficient flow is assured in piping systems using Tube-Turn welding fittings. Every fitting is checked for inside smoothness.

Maximum efficiency of flow is important to industry. Other advantages of Tube-Turn welding fittings over other fitting types include: Greater strength, less weight, lower maintenance costs. Tube-Turn welding fittings permit greater flexibility of layout, are easier to insulate. Increased safety at points of highest pressure and longer life for the entire system are more reasons for specifying Tube-Turn welding fittings.

For complete information on the superiority of Tube Turns' exclusive manufacturing methods and data on successful installations in many industries, write for Catalog 111. Distributors in all principal cities.

Selected Tube Turns Distributors in every principal city are ready to serve you from complete stocks.

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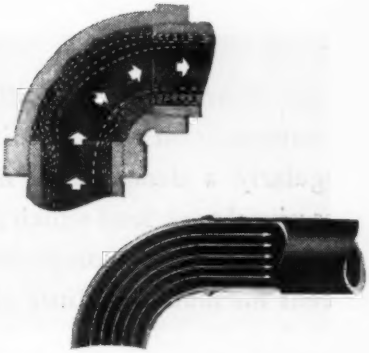
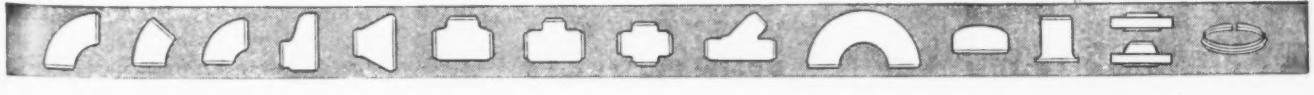
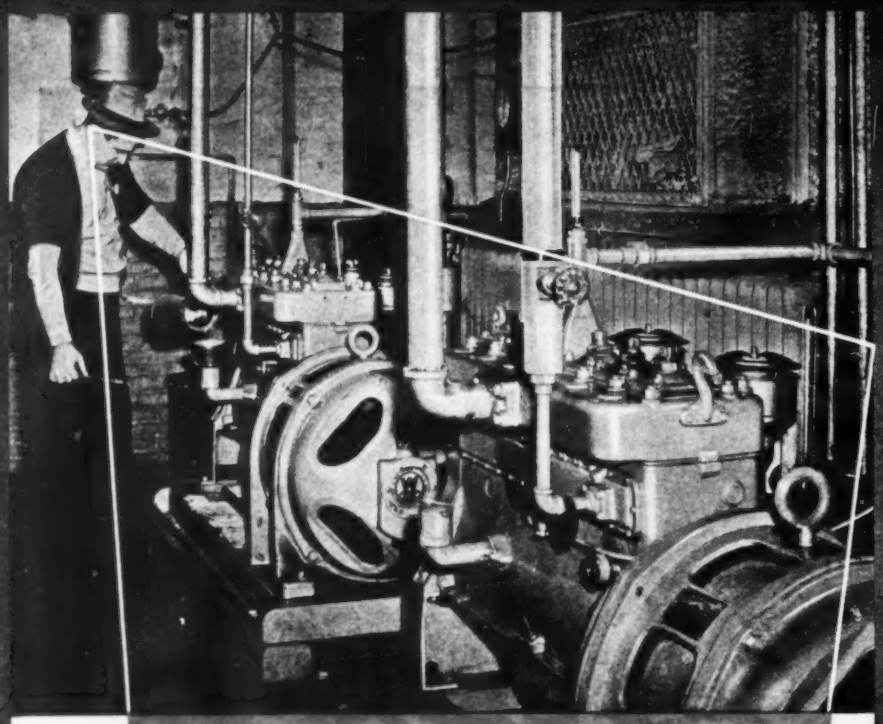


Compare for Smoothness

See how sharp corners and surface irregularities obstruct flow in cast iron threaded elbow. Compare for smoothness with unobstructed flow in smooth Tube-Turn elbow.

TUBE-TURN TRADE MARK *Welding Fittings and Flanges*





YOU SAVE
WHEN YOU INSTALL
SCHRAMM
AIR COMPRESSORS
IN UNIT SYSTEMS

Here is an interesting illustration of two Schramm Air Compressors at work, furnishing air in a plant where there is regularly a demand for medium amount of air—and an *occasional* peak load which requires a lot of electrical current and air. The two compressors take care of the *variation* of needs for much and little air.

Schramm compressors have 3 outstanding features that make them economical and easy to operate: (1) 100% water-cooled, (2) lightweight and compact, (3) vibrationless, even when providing great amounts of air.

These—and many other features—make Schramm Air Compressors the best compressors for your plant. Write today for full data.

SCHRAMM INC.
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

to eliminate the troublesome sweating.

2. A heat exchanger functions as a dryer coil to prevent entrained liquid particles being carried to the compressor.

3. A long suction line, unless insulated, may warm the suction vapor considerably if the line passes through an unrefrigerated space. It is better to let the warming take place where superheating is useful.

Study pipelines between different parts of the plant because successful operation depends on properly connected equipment. Small and exposed suction mains cause considerable trouble. The refrigerant, after boiling in the evaporator, is saturated and picks up superheat by cooling the incoming liquid. Additional superheat picked up through long and exposed lines burdens the compressor. Never try to save tubing and pipe by using undersized suction lines that introduce considerable friction loss. Fig. 2 shows the effect of too great a suction-line pressure drop that causes higher evaporator temperature and lower suction pressure at the compressor with the accompanying lower refrigeration tonnage.

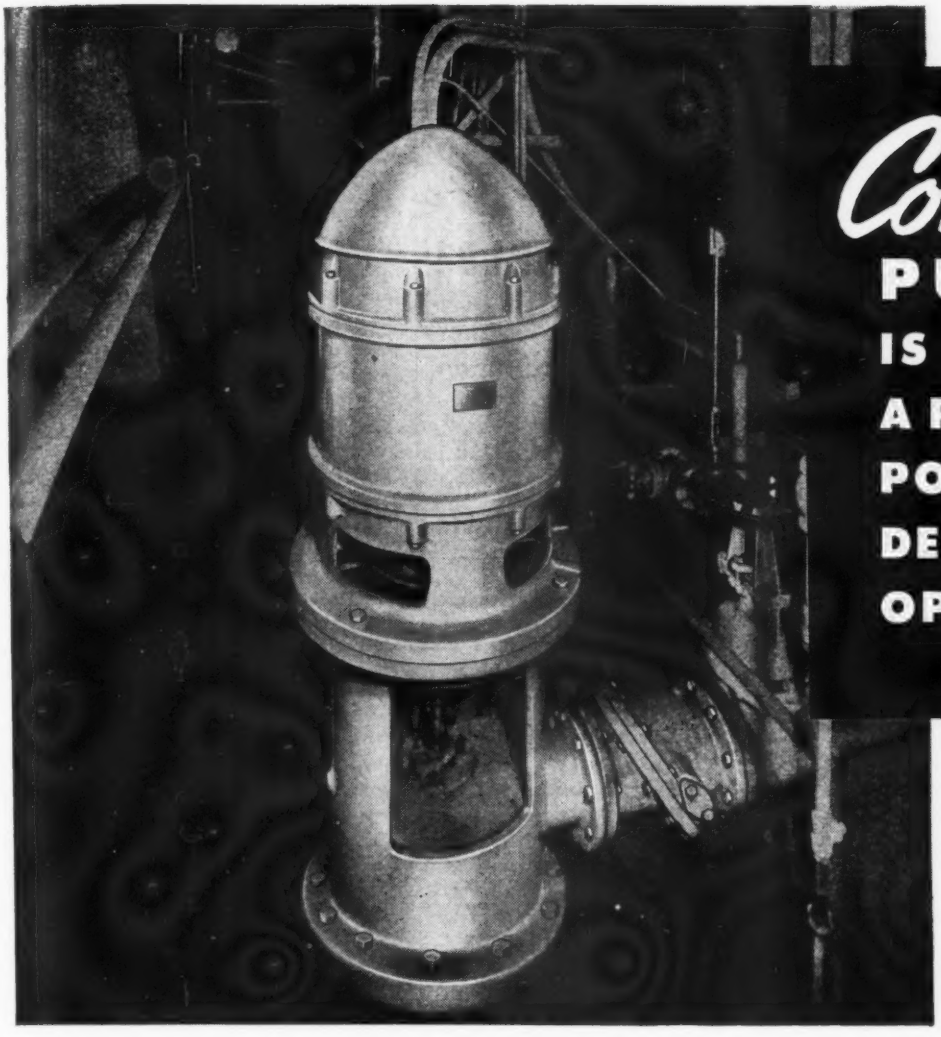
Receiver Location

Study refrigerant receiver and piping carefully and exercise extreme care to keep liquid-refrigerant temperature low. Placing the receiver in a hot engine room may improve plant layout immensely, but it is comparable to running cooling-water lines through a boiler furnace. External heat simply evaporates part of the liquid, thereby reducing its refrigerating effect per brake horsepower, and drives vapor back to the condenser to be recondensed. Such arrangements necessitate larger condensers and more cooling water per ton of refrigeration.

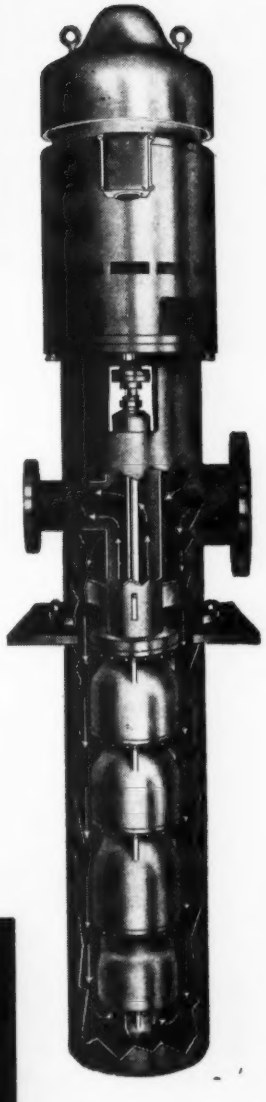
Overhead evaporators with long liquid lines require cooler liquid and higher pressure because, if the liquid-line pressure drops to a point where flashing takes place, some of the refrigerating effect is lost. Again, if the liquid must rise to an overhead evaporator, reduced pressure, occurring as elevation increases, may reach such a value that flashing takes place ahead of the expansion valve.

To make an intelligent decision on how much evaporator-coil surface to install for a particular job study the characteristics of expansion, wet compression and flooded evaporating systems. Compare the three systems as follows:

A dry-compression plant with an expansion evaporating system needs (1)



Condensate PUMPING IS NO LONGER A PROBLEM FOR POWER PLANT DESIGNERS OR OPERATORS...



WHEN BYRON JACKSON VMT PUMPS ARE INSTALLED

This vertically mounted multi-stage pump, arranged in a barrel, eliminates the elaborate and objectionable pit, minimizes the space requirement, and permits installation at the most suitable location with the least piping.

The *required* npsh (net positive suction head) may be easily reduced by increasing the number of pump stages, or the *available* npsh may be increased by lengthening the barrel and positioning the first stage of the pump at any desired level.

With its stable operating characteristics over the whole range, this pump functions equally well at any plant load. There is only one stuffing box—under discharge pressure—thus excluding air leaks. The vertical shaft—free from deflection—assures long life for the packing.

The first units of this type, installed in a location where ground conditions were particularly bad—thus excluding a pit—and with greatly varying plant loads, have been in uninterrupted operation since 1934.

Write us today for the new VMT Pump Bulletin

BYRON JACKSON CO.

Houston • LOS ANGELES • New York

NO VALVE LIKE *Multi-Valve* IN ALL THE WORLD!

Here is a different type of valve, particularly adapted to higher pressures and temperatures, designed and constructed upon proved scientific principles.

The Ludlow Multi-Valve design answered industry's need for a valve that will provide a tight closure at all pressures and temperatures — for steam, air, gas, water, oil, viscous liquids and solutions — that will give a smooth throttling action without erosion, defeat the action of scale, and virtually renew its seat automatically.

The Ludlow Multi-Stage Cone affords:

1. A metal-on-metal seating that cuts through scale and viscous liquids and insures a positive shut-off that will not simmer.
2. A multi-stage opening action that reduces the pressure and velocity step by step, cushioning and giving a perfect throttle without erosion.
3. A multi-seat principle that insures a tight seal with all fluids, at all temperatures and pressures; that prevents distortion; and that cleans its seat at each closing.

M-1

The LUDLOW VALVE SINCE 1866
MFG·CO·INC·TROY·N·Y·

medium-sized compressor (2) large-sized evaporating system (3) small amount of refrigerant.

A dry-compression plant with flooded evaporating system needs (1) small-sized compressor (2) small-sized evaporating plant (3) large amount of refrigerant.

A wet-compression plant with wet compression-evaporating system needs (1) large-sized compressor (2) medium-sized evaporating system (3) medium amount of refrigerant.

Insulation Increases Electrical Machine Rating

As much as 50% reduction in weight of electric equipment is possible, where design limitations are based on insulating temperature, by using the new Westinghouse Silicone insulating varnishes. These high-temperature insulations also make possible a substantial increase in the output of small motors using the same frames, where operating temperature can be raised. They offer the additional advantages of ability to operate at higher ambient temperature, and to increase life greatly when operated at present temperature conditions. Silicone resins, and their use as insulating varnishes and bonds, fill the void between organic and inorganic insulating materials.

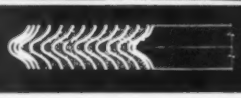
Over two years' experience on actual equipment confirms extensive laboratory tests, which showed these materials to be promising. For example: To meet a very special requirement, a 3-hp totally inclosed induction motor was redesigned for 10 hp with no increase in weight or size. Since then, more than 30 similar motors using high-temperature insulation have been built and are now being tested under various conditions.

A mine locomotive motor armature has been functioning satisfactorily under adverse conditions for over a year since being rewound and high temperature insulated. Before this, insulation failures occurred frequently—a few less than a month apart. Street car and trolley coach motors with Silicone insulation have been given exhaustive tests at elevated temperatures. Results show increased horsepower output at no increase in speed with no injury to insulation.

A 250-kva generator with high-temperature insulation was operated in the laboratory for about 3000 hr at 250 C with no ill effects to the insulation. According to the best available means for interpreting accelerated life tests, this should be equivalent to far more than normal life expectancy.

Air-Raid Street Lamp. As part of U. S. preparedness against future aggressions, a new street lamp has been developed. Fixtures, to be spaced 100 ft apart, permit a light spread equal to starlight—or 1/100th of moonlight. Fixture is painted black, with light channeled through a narrow plastic band.

SPIRALWOUND . . .

Type 4-Y 

This Metal-Asbestos "Sandwich"

Makes Sealing Warped and Pitted Flanges *A PICNIC*

SPIRALWOUND — an extremely popular gasket for standard or special flanges and boiler tube caps, hand-holes or man-holes —is composed of interlocking plies of preformed metal, cushioned with Asbestos strip, spirally-wound together.

Under compression, the central spring-like corrugation of the metal strip enables the gasket to seal warped or irregular flange faces and provides unequalled resilience to compensate for expansion and contraction in service. In addition to the multiple-sealing action of this metal strip, the Asbestos cushion also fills irregularities in flange faces to assure a tight closure.

SPIRALWOUND Gaskets have great mechanical strength, are highly resistant to corrosion and temperature extremes, have proper compressibility with relatively light bolting. Rugged construction permits re-use a number of times when seals must be broken.

This better gasket is another example of modern Gasket Engineering. To keep you posted on the latest gasket developments, we will be glad to send you a series of technical bulletins containing original data resulting from continuous research in the unique Goetze Laboratory. Please write on your company letterhead, mentioning your position.

GOETZE GASKET & PACKING CO., INC.
10 ALLEN AVENUE, NEW BRUNSWICK, NEW JERSEY

LOWELL THOMAS Speaks on New Gasket Film

Now available to employee groups, technical societies, engineering schools and other organizations throughout the country, this new 35-minute Kodachrome film, "Only a Gasket," tells why these are the "Biggest little things" in modern Industry. Write for full information.

Goetze for GASKETS

"America's Oldest and Largest Industrial Gasket Manufacturer"

LIGHT . . . but STURDY

If you want to see how lightness can be combined with utmost sturdiness in a Portable Pop or Relief Valve, just look at and then study the FARRIS design. You'll find the bowl-shaped body generously proportioned, and the springs extra large . . . yet with no unnecessary weight anywhere on the valve. In addition, like all FARRIS Safety and Relief Valves, you'll find this a truly precision built valve of highest quality in every detail.

Built in sizes from ½ in. to 2½ in. and for pressures to 250 lb. steam. Write for full information without obligation . . . you'll find it well worth while to become acquainted with this outstanding value in Pop Valves.

FARRIS ENGINEERING COMPANY
366 Commercial Ave. Palisades Park, N. J.

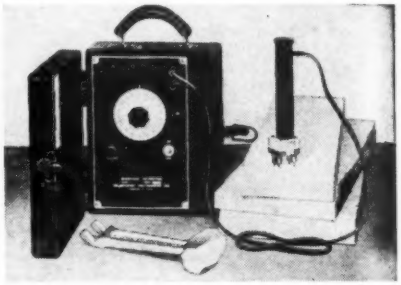
Farris
RELIEF
POP VALVES

New Equipment

(*Continued from page* 126)

it suitable for electronic heating equipment that must withstand shocks and vibration in plant operations. Oversized filament insures abundant emission throughout tube life, according to maker, and an extra-heavy anode wall provides large thermal capacity for added protection against momentary overloads.

Rated at 3500 watts input, this power tube operates at full ratings at frequencies up to 50 megacycles. Maximum ratings are: dc plate voltage 3500 v, dc plate current 1.0 amp, plate dissipation 1200 watts. Filament current is 27.5 amp at 11 v. F-5303 model is for forced-air cooling but can be supplied for water cooling in model F-5303. *Federal Telephone & Radio Corp, 32 Central Ave, Newark 1, New Jersey.*



Moisture Detector

DELMHORST MODEL R detector, for lumber and wood products and various construction materials, operates on batteries. Both surface and subsurface readings are obtainable. Electrode needles penetrate surface, without marring material, and measure moisture content. Reading is then taken by turning dial knob until a small light above dial flashes at correct moisture content. Detector weighs only 6 lb. Case protects instrument. *Colloid Equipment Co, 50 Church St, New York 7, N. Y.*

Copper Plating

ADHERENT, UNIFORM COPPER plating is now possible on aluminum and its alloys by a simple preparatory dipping solution in a steel, wood or ceramic container at room temperature. Plating solution may be practically any copper electrolyte except sulphate types or those having a high degree of acidity.

Flash coat of copper eliminates aluminum soldering difficulty. Aluminum also has a strong tendency to develop an insulating oxide coat by air exposure, which reduces electrical conductivity of aluminum. When copper plated to overcome this difficulty aluminum becomes useful for electrical contacts and high-frequency conductance. Copper-plated aluminum serves as a base for further plating, such as nickel, cadmium, chromium, zinc, etc. It eliminates usual dull aluminum finish. Copper-plated aluminum builds up worn surfaces,

What do you want to know about Turbine Oil?

Recently a number of utility plant men were asked, "What do you want to know about turbine oil?" Several of them had very specific questions. They are answered here because they may help you in selecting a turbine oil that solves, once and for all, the ever present problem of turbine oil maintenance. One question is taken up each month, but you can get the answers to all of them now—see the booklet offer.

6. What causes corrosion in turbines?

Corrosion, like acidity and deposit trouble, in turbines is a complex problem. A complete explanation of its causes would require a review of turbine developments and a thorough knowledge of the various types of corrosion that may occur in turbines. Briefly, here's what has brought about the corrosion which has bothered some turbine operators in recent years.

As turbine efficiency was improved over the years by higher steam pressures and temperatures, oils that had been satisfactory for older turbines began to form sludge and other deposits. To eliminate these deposits, more highly refined oils were introduced. But the higher degree of refining, which removed some of the deposit-forming elements, also removed natural corrosion inhibitors from the oil. This resulted in a new and serious type of corrosion.

There are two types of corrosion. Common rust (Fe_2O_3) is the most familiar type. It occurs on ferrous metal parts such as storage tanks, reservoirs, and oil lines where there is moisture above the oil level, or where water accumulates in pockets and depressions. This type does little damage unless allowed to continue over a period of years. Parts subject to such damage are sometimes treated with special protective coatings.

The most serious type of corrosion which has developed in recent years is caused by water carried in suspension in the oil. Even a small percentage of moisture—as low as 0.1%—will cause this corrosion. It forms dense, hard crystals of magnetic iron oxide (Fe_3O_4) which are highly abrasive and severely score bearings—can clog oil lines and governor mechanisms in short order.

Hundreds of tests were made in Standard Oil laboratories to find an additive which would give complete protection against corrosion. Many products were excellent as rust preventives, but because of high acidity, poor demulsibility, etc., could not be used without impairing the other necessary qualities of a turbine oil. For example, used oils give protection against certain types of corrosion. But when added to new oil, even in small quantities, these used oils accelerate acidity and deposit formation.

From these tests, however, emerged a thoroughly satisfactory corrosion inhibitor for turbine oil. This inhibitor is used in Nonpareil in addition to the oxidation inhibitor. Recently the American Society for Testing Materials developed test D665-42T for determining the ability of turbine oil to aid in preventing the rusting of ferrous parts in the presence of water. Nonpareil Turbine Oil is manufactured to pass this test with perfect results. The corrosion inhibitor in Nonpareil does not affect its resistance to deposit formation, or its guarantee to eliminate excessive oil acidity "for the life of your turbine."

Gasoline Powers the Attack...
Don't Waste a Drop!

For all the answers send for this booklet...it contains answers to questions such as these:

1. What causes turbine oil deposits or sludge?
2. What causes acidity increase in turbine oil?
3. What is an oxidation inhibitor – how does it prevent acidity?
4. How does a guaranteed turbine oil protect the user?
5. Does the inhibitor in Nonpareil Turbine Oil wear out?
6. What causes corrosion in turbines?

Send for a copy of this booklet, or better still, ask for a Standard Lubrication Engineer. He can answer your specific questions about Nonpareil Turbine Oil. Write Standard Oil Company (Indiana), Room 1223, 910 S. Michigan Ave., Chicago 80, Ill., for a copy of the booklet, or the Engineer nearest you.

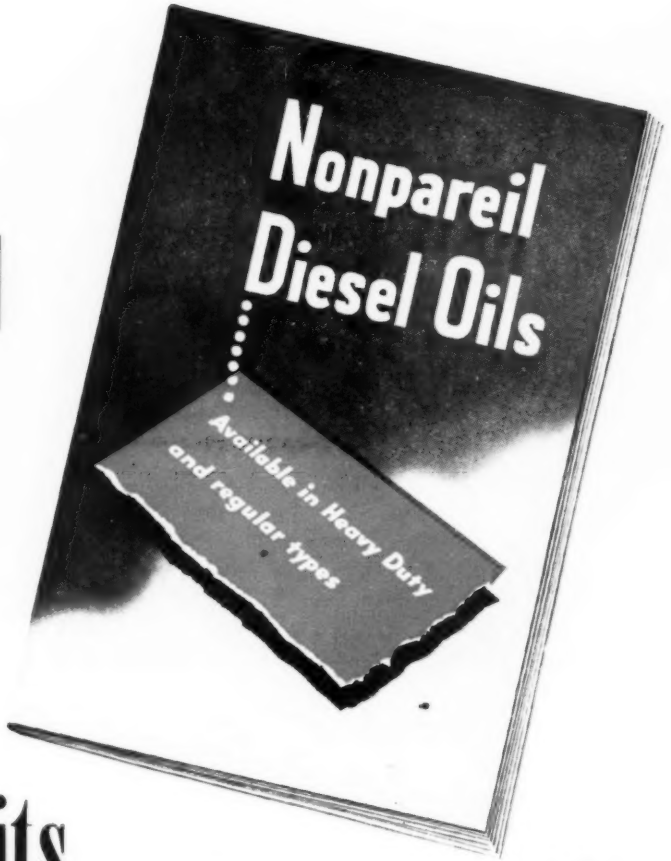
NONPAREIL TURBINE OIL

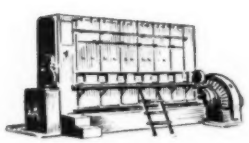
STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

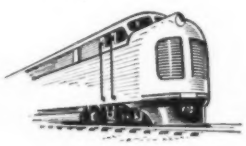
LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

Eliminate stubborn and troublesome varnish and sludge deposits with . . .





For Industrial Diesels



For Railroad Diesels

NONPAREIL
DIESEL OILS

Gasoline Powers the Attack . . . Don't Waste a Drop!

Send for this booklet!

It tells why the heavy-duty, detergent grades of oil were added to the Nonpareil line of Diesel Oils, and how they insure engine cleanliness even under the adverse operating conditions of today.

It contains useful information such as: hints on filtering of heavy-duty oil, and tables on cooling water recommendations of various Diesel manufacturers. Write the nearest local Standard Oil Company (Indiana) office, or 910 South Michigan Avenue, Chicago 80, Illinois, for this brief factual booklet on Diesel lubrication.

STANDARD OIL COMPANY (INDIANA)

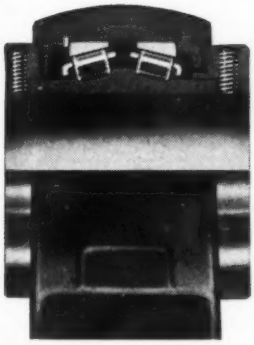
STANDARD SERVICE

★ LUBRICATION ENGINEERING

30,000 HOUR SERVICE AT *Lower Cost*

with new

DODGE-TIMKEN TYPE "E" BEARINGS



Genuine Timken tapered roller bearings handle any combination of radial and thrust loads in normal installations.

Extra long inner race distributes the load.

Time-tested method locks bearing on shaft.

Simplified labyrinth seals protect against dust, dirt and loss of lubricant.

Factory assembled, adjusted, lubricated, ready to install.

TRANSMISSIONEERING achieves a new combination of high performance with low cost! Type "E" is the lowest priced Timken-Bearing-equipped mount on the market. There is no sacrifice of quality; the low price is the result of Dodge Transmissioneering skill, and efficient, volume production.

Precision-built, rugged, dependable, the new Type "E" bearing assures 30,000 hours or more, of service, under conditions for which it is adapted. It offers superior load carrying and high speed capacity.

Type "E" bearings, completely assembled, lubricated and adjusted at factory, ready for immediate use, are available in Dodge distributors' stocks. Call the Dodge Transmissioneer in your territory for information about these, *and other new developments in power transmission equipment,* to help you increase production efficiency and lower your power costs.

DODGE MANUFACTURING CORPORATION
MISHAWAKA • INDIANA

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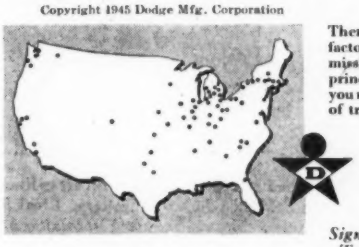


There are 210 Dodge factory graduate Transmissioneers, located in principal cities, to show you new and better ways of transmitting power.

Sign of the Dodge Transmissioneer

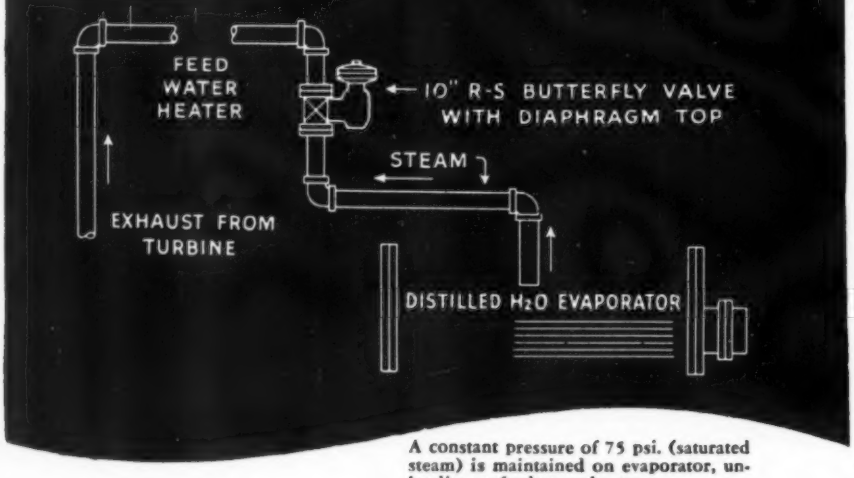
DODGE
MISHAWAKA

DODGE ROLLING BEARINGS . . . THE 30,000 HOUR LINE

TRANSMISSIONEERED MEANS ADVANCED DESIGN IN POWER DRIVES

INSTALL WITH EASE

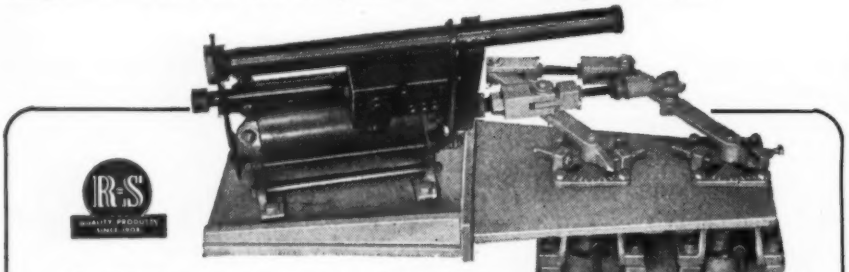
NO JAM! NO FREEZE!!



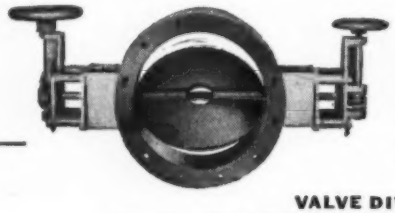
A constant pressure of 75 psi. (saturated steam) is maintained on evaporator, unloading to feed water heater.

Because of the comparatively light weight and compact construction of R-S Butterfly Valves, less supporting structure and space are required. As a consequence, substantial savings in installation costs are effected. Simplified design and standardized construction mean lower first cost and ease of installation.

R-S Butterfly Valves are machined to close tolerances depending on temperature conditions. There is no tendency to jam or freeze. In any line, they sting the maintenance bill every time. Ask for Catalog No. 14-B.



No. 625. 150-pound three-way valve with air cylinder positioner control and adjustable linkage. Ideal for quick control and wedge-type shut-off in mixing and interchange service. Precision engineered, metallurgically and mechanically.



No. 608. Designed for either a high pressure drop and small volume or a low pressure drop and large volume. The large vane seats against the body of the valve while the smaller vane is free revolving. Four to six revolutions of handwheel completely open or close vane. Adapted to power operation.

VALVE DIVISION

R-S PRODUCTS CORPORATION

4536 Germantown Ave. • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

oversized diameters, etc, and may be finished in many lightfast colors for decorative and identifying purposes. *Technical Processes Div, Colonial Alloys Co, Philadelphia 29, Pa.*

Pressure Gages

SPRING AND BELLOWS actuated pressure gages measure ranges between zero and 5 in. and zero and 50 in. of water. Two gage designs are introduced. One gage has a single spring for pressure ranges. The other has a second spring, in tandem with the first, for vacuum and compound ranges. New models are for combustion pressures, engine manufacturing, processing, testing, etc. *Brown Instrument Co, Philadelphia, Pa.*

Welding Electrode Carrier

ATLAS DUAL-CASE prevents scrapping of welding electrodes because of cracked and chipped flux coating. Case suspended from welder's belt carries an electrode supply. An extra case division carries an *Atlas* weld-cleaning tool. Capacity is 8 to 10 lb of electrodes. *Atlas Welding Accessories Co, 14824 Wyoming Ave, Detroit 21, Mich.*

Sealing Strip

STRIP-SEAL adheres to wood, metal, masonry, tile, glass and other surfaces. Applied without tools, it is ideal for weather-stripping, puttying and caulking. *Tremco Mfg Co, 8701 Kinsman Rd, Cleveland, Ohio.*

Swivel-Head Scale

KRON SPRINGLESS dial scale with a swivel head assures operator of a full, unobstructed view of dial chart and dial indicator at all times. Swivel-head device allows dial head to rotate freely and smoothly through a complete circle at convenience of operator and does not affect accuracy or efficiency of dial mechanism. As an integral part of the conveyor line, position or location of scale is not limited as dial head can be swiveled to most convenient angle to eliminate point-of-view differences. This feature also permits 2-man operation—one

What to do about Rust?

Make this Test

Immerse any rusty nail in a small quantity of Cities Service Rust Remover. If badly rusted, allow to remain for several minutes. You can actually see the rust dissolve.

See the Results

Remove nail and wipe dry with cloth or tissue. Note the complete absence of rust and the way the original surface reappears.

CITIES SERVICE RUST REMOVER has been tested for four years throughout a small, highly industrialized area in the East, where it has earned a unique reputation for performance. RUST REMOVER is a clean, clear liquid, practically odorless, non-inflammable, easily applied, and harmless to handle by those not allergic to specific chemicals. It is fast-acting, and, although heating somewhat accelerates results, general application is recommended at normal temperature (60°-90°F.). RUST REMOVER is effective on chromium, copper, aluminum, steel and iron.

5 Big Advantages

1. Non-Inflammable
2. Harmless to Normal Skin
3. Makes Metals Chemically Clean
4. Removes Rust by Chemical Action
5. Free from Muriatic, Sulphuric, Nitric and Oxalic Acids or Cyanide.

See a Free Demonstration of Rust Remover on Your Own Equipment.

(Available only in Cities Service marketing territory East of the Rockies.)

MAIL THIS COUPON TODAY!

CITIES SERVICE OIL COMPANY
Room 195
Sixty Wall Tower, New York 5, New York

Gentlemen: I'd like to test RUST REMOVER on my own equipment FREE OF CHARGE. Send me details.

Name .....

Company .....

Address .....

City ..... State .....

CITIES SERVICE OIL COMPANY
NEW YORK · CHICAGO

IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.

Wallace & Tiernan Desliming Installations *never give slimes a chance* to deposit in condenser tubes or on heat exchanger surfaces. When included in your specifications, reductions in size, weight and investment in basic heat exchange equipment are positive.

Whether you are building a new plant or increasing the production of your present one, Wallace & Tiernan engineers will gladly give you technical information on the prevention of biofouling and bacterial corrosion in cooling-water systems. CD-11

WALLACE & TIERNAN PRODUCTS, INC.

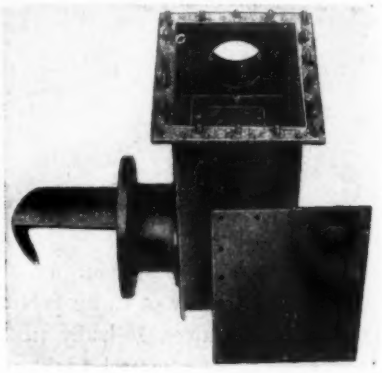
Manufacturers of Chlorine and Ammonia Control Apparatus

Belleville 9, New Jersey ● **Represented in Principal Cities**

man to load and unload platform continuously from front while other takes dial chart readings from scale rear without interference from loading operations. *Yale & Towne Mfg Co, Philadelphia 24, Pa.*

Solvent Cleaner

CYCLODIENE FN is a single-operation degreaser, cleaner, fingerprint and body-acid neutralizer. Immerse work or spray it with cleaner. No special equipment is required. *Technical Processes Div, Colonial Alloys Co, Philadelphia 29, Pa.*



Foam Chamber

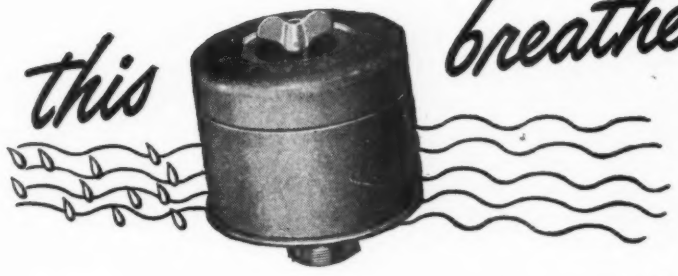
EVERTITE FOAMITE DELIVERY chamber is for foam fire protection on modern oil storage pressure tanks. Chamber provides an easy method of applying a blanket of fire-smothering foam to burning oil surfaces, yet prevents release of tank pressure. Glass diaphragm seals inlet of *Firefoam* passageway to tank. This permits top plate of delivery chamber to be removed for painting or for diaphragm inspection without releasing any tank vapors. Diaphragm is glazed in a removable steel frame. Extra framed diaphragms may be kept in stock, simplifying replacements. Frame lip gives strong support to resist tank vapor pressure. *Firefoam* pressure at time of fire is adequate to cause breakage, as diaphragm ruptures at low pressure from upper side. New deflector, permanently attached to throat, eliminates any special baffle installation. *American-LaFrance-Foamite Corp, Elmira, N. Y.*

Flameproof Paint

BLAZE-PRUF SILVER-LUME, a brilliant metallic flameproof paint with rust preventive features for extremely hot surfaces, tolerates up to 1800 F heat and can be applied over cold or hot surfaces. Paint stands actual flame without destroying film. *Wilbur & Williams Co, Boston, Mass.*

Mica Ceramic Insulation

MYKROY, a 19½x29¾-in. sheet of glass-bonded mica ceramic insulation, is said to be twice the size of former sheets, which makes possible more efficient cutting and reduces amount of waste in fabricating a given number of parts. Sheets range in thicknesses from ⅛ to 1½ in. Because of its greatly increased size this high-fre-

this  *breather*

KEEPS OIL IN ITS PLACE

... another example of Air-Maze engineering

In ventilating crankcases and gearcases in engines, compressors, and other machines, oil can be lost by becoming entrained in air. Preventing this loss eliminates excessive oil consumption, nuisance and hazards. So for this purpose Air-Maze provides a line of breathers incorporating an oil-separating feature that returns the oil to the crankcase or housing.

You may never require a breather, but you can have *engineered filtration* in every Air-Maze filter. Whether your interest in filters applies to air conditioning, ventilating, compressors, blowers or engines, remember—"if it uses air, use AIR-MAZE".

AIR-MAZE CORP. • CLEVELAND 5, O.

Representatives In Principal Cities. In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor
Fleck Bros., Ltd. Vancouver.

For further data on types and application of Air-Maze filters, send for Catalog AGC-144.

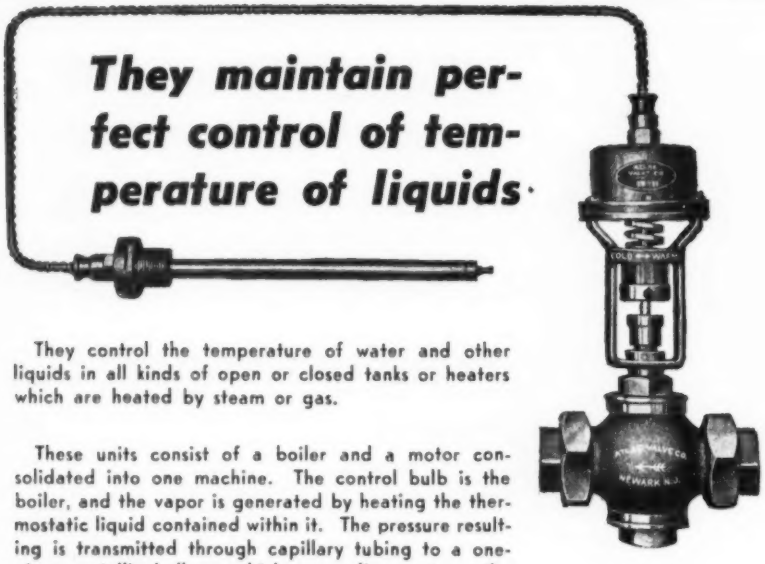
IF IT USES AIR...USE

AIR-MAZE

ENGINEERED AIR FILTRATION

ATLAS
Self-Contained
TEMPERATURE REGULATORS

They maintain perfect control of temperature of liquids



They control the temperature of water and other liquids in all kinds of open or closed tanks or heaters which are heated by steam or gas.

These units consist of a boiler and a motor consolidated into one machine. The control bulb is the boiler, and the vapor is generated by heating the thermostatic liquid contained within it. The pressure resulting is transmitted through capillary tubing to a one-piece metallic bellows, which, expanding, acts as the motor for operating the valve which regulates the admission of the steam or gas used to generate the heat. The control valves operated by bellows have seats suitable for the service.

ATLAS No. 650

Balanced Type Double Seat Valve. Spring Adjustment. For temperatures from 70° to 300° F. Bulb is immersed in liquid and control valve installed in steam supply. ½", ¾", and 1" for steam pressures up to 150 lb. 1¼", 1½", 2", and 2½" for steam pressures up to 100 lb. Operates in vertical or horizontal position.

ATLAS No. 651

Needle Type. Single Seat Valve. Spring adjustment. For temperatures from 70° to 300° F. Used where tight seating valve is essential such as on small oil heater pump sets, open or closed tanks, sterilizers, glue heaters, etc. ½" and ¾" for steam pressures up to 150 lb. Operates in vertical or horizontal position.

ATLAS No. 655

Balanced Type. Double Seat Valve. Lever and Weight Adjustment. For temperatures from 70° to 300° F. Lever and weight adjustment of control valve assure high sensitivity. For maintaining temperature of liquids in all kinds of tanks and heaters. ½", ¾", and 1" for steam pressures up to 150 lb. 1¼", 1½", 2", 2½", 3", 4", 5", 6", and 8" for pressures up to 100 lb. Operates in horizontal pipes.

ATLAS No. 660

Single Seat Self-Contained Pilot-Operated Valve. Spring Adjustment. For temperatures from 70° to 300° F. For use where accurate regulation demands a quick opening and closing control valve and where steam pressure is always 25 lb. or more, as for instantaneous heaters and tanks for water, oil, etc. ½", ¾", 1", 1¼", 1½", and 2" for steam pressures up to 300 lb. 2½", 3" and 4" for steam pressures up to 250 lb.

Write for Bulletin 7A giving detailed information

Other ATLAS Products:

Check the items below on which you would like to have data and mail to us with your name, firm name and address.

- ☐ Damper Regulators
- ☐ Temperature Regulators
- ☐ Reducing Valves
- ☐ Exhaust Control Systems
- ☐ CAMPBELL Boiler Feed Water Regulators
- ☐ Pump Governors
- ☐ Pressure Regulators
- ☐ Float Valves
- ☐ Oil Control Cocks
- ☐ Humidity Controllers
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

SPECIALISTS IN REGULATION FOR NEARLY A HALF CENTURY

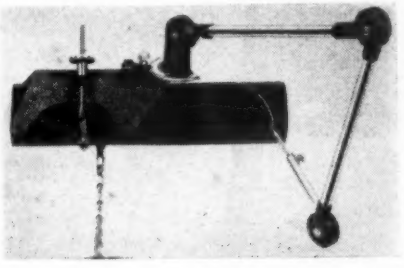
289 South St., Newark 5, N. J.

Representatives in Principal Cities

quency insulation may now be used for switchboard panels, large inductance bars, transformer covers, large meter panels, switch connecting rods, radio-frequency or electrical-equipment bases, structural members in radio-frequency equipment where low-loss insulation is indispensable, etc. *Electronic Mechanics, Inc, 70 Clifton Blvd, Clifton, N. J.*

Mallets and Hammer Faces

EMPIRE MALLETS AND BASA replaceable face hammers are now made with aluminum heads and faces. Single mallet or hammer is for every kind of work where a soft-faced striking tool is required. When worn, heads or faces of aluminum are readily cut, turned or ground for longer use. Split-jaw design of *Basa* hammer head further assists quick face replacement. Aluminum faces are interchangeable with plastic, rawhide, copper and babbitt faces. *Greene, Tweed & Co, Bronx Blvd at 238th St, New York 66, New York.*



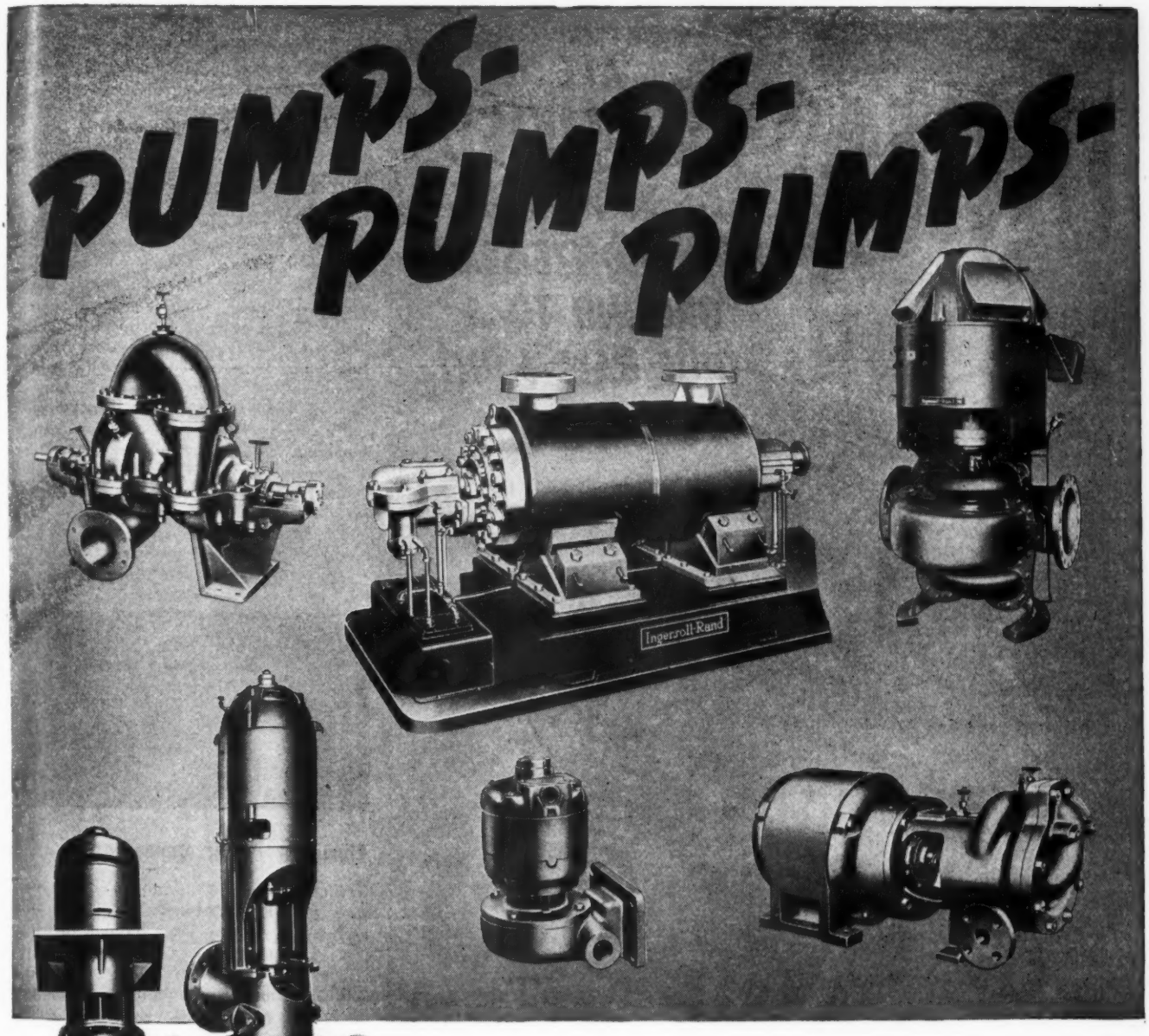
Sturdy Protractors

PIPE, STRUCTURAL SHAPES and flat sheets are scribed for cutting on any angle to one-half of a degree with *Trumark* protractor, which is being manufactured again. Protractors are in two stock models, three sizes. Model shown scribes pipe circumference 3 to 18 in. in dia. Operation is claimed to be quick and accurate. This protractor, built for hard service, is made of precision-machined cast-bronze alloy and steel tubing. Another size of this model marks pipe 12 to 36 in. in dia. *Junior Trumark* protractor, of sturdy die-cast construction, marks pipe or rod ½ to 3 in. in dia.

For flat surfaces, channel iron, *T* or *I* structural shapes, protractor is set up as on pipe, or held square to any edge or corner. Plumb bob indicator and spirit level show any angle degree from a horizontal plane. *Tru-Line Corp, 759 Venice Blvd, Los Angeles 15, Calif.*

Turbine Blades

STRONGER IMPULSE BLADES for high-pressure steam turbines are ready for the time when greater steam loadings are imposed. Root of each blade is shaped like an inverted *U*. Three blades are brazed together forming one solid segment, which fits into circumferential grooves in spindle. With segments in position holes are drilled crosswise through rotor and through edges of two adjoining segments. Pins are then driven through these holes and ends peened. Result is a tightly locked structure in



Little pumps... big pumps... special pumps... standard pumps...

Pumps for water... pumps for oil... pumps for food... pumps for chemicals.

Marine pumps... boiler-feed pumps... refinery pumps ...coolant pumps... paper-stock pumps.

Yes! centrifugal pumps are our business. There is a complete range of sizes to meet any common and many unusual liquid moving problems. An experienced staff of engineers is available to help you find the pump to meet your needs. Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York 4, N. Y.

Ingersoll-Rand

10-520

CENTRIFUGAL PUMPS • CONDENSERS • COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES

DARTS ARE IDENTIFIED BY THEIR TWO BRONZE SEATS GROUND TO A TRUE BALL JOINT

THE way to recognize a Dart Union is by its two bronze seats ground to a true ball joint—the unique construction that makes Dart the *better* union.

Perfect contact of seats insures a leakproof joint without ruinous wrenching — unions uncouple instantly as often as needed in other locations. Bodies and nuts—made of high-test air-refined malleable iron—are practically unbreakable.

For long, trouble-free service, and consequent low cost, always specify Darts.

"IT PAYS TO BUY DARTS"

DART UNIONS

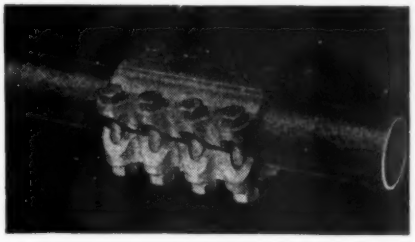
E. M. DART MANUFACTURING COMPANY

PROVIDENCE 5, R. I.

which areas carrying stress are positively known. Any segment of three blades can be removed directly without disturbing any other segment. Blade is smaller for the same steam-working area. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Chromate Gaskets

GASKETS, $\frac{1}{8}$ and $\frac{1}{16}$ in. thick, consist of a felt base impregnated with a chromate-pigmented compound which renders material flame, fire and corrosion resistant. Dark green in color, they maintain air pressures up to 25 psi at normal temperatures. In addition to sealing joints in air-ventilator lines, forced-draft blowers and similar equipment, chromate gasketing may be used in flange-to-flange joints in drainage, fire main, fresh water, flushing, sprinkling, plumbing, fuel-oil and diesel-oil systems. They may serve for watertight or oiltight connections to structures and as gasketing for air-lock doors and relief valves, jointer and refrigerator doors and flame-resistant closures. *Sherwin-Williams Co, Cleveland, Ohio.*



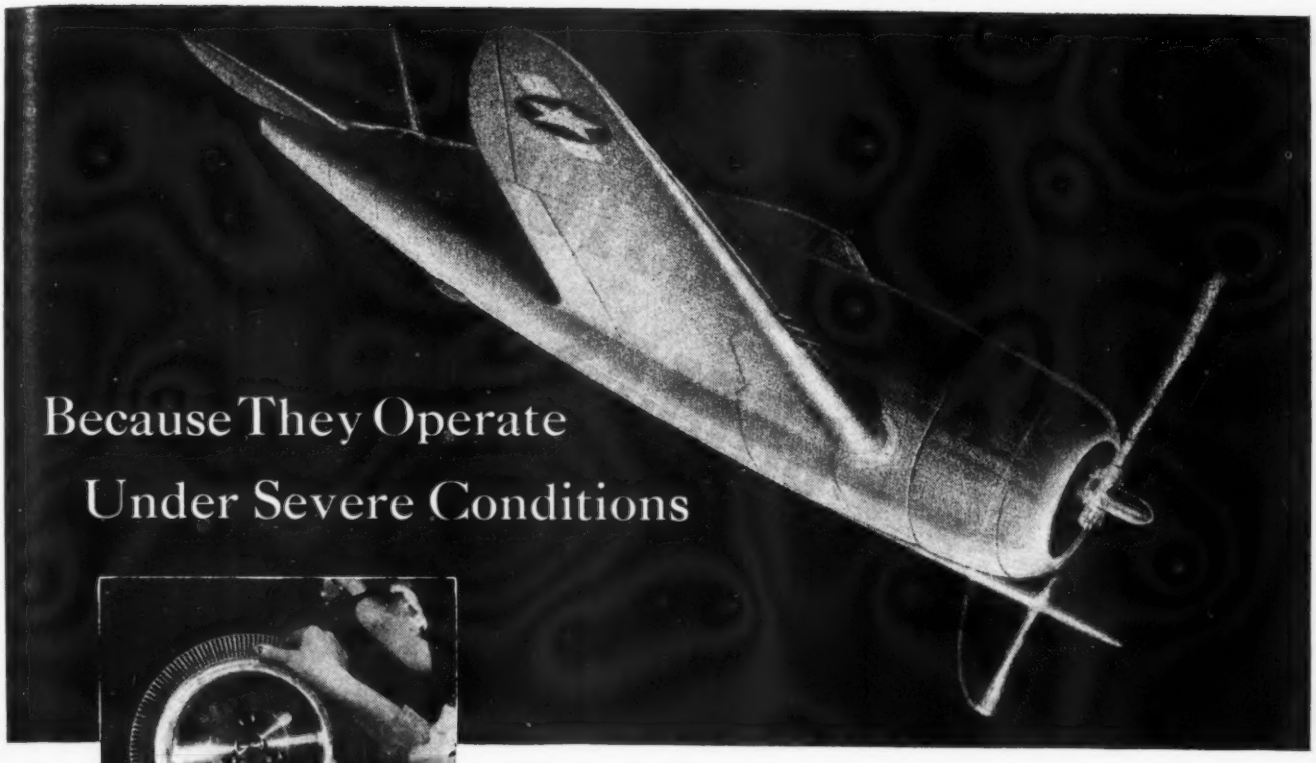
Aluminum Power Connectors

NEW LINE features a full range of types and sizes for all aluminum-to-aluminum connections, as well as for aluminum to copper. Produced from a heat-treated aluminum alloy high in strength, conductivity and elongation, connectors differ from conventional copper models. Connectors compensate for the differences in electrical and physical properties of the two metals. High elongation of aluminum alloy permits connectors to conform tightly to conductors under pressure without danger of cracking. Wall thicknesses are said to be greater, bosses thicker, radii and contact surfaces larger. *Burndy Engrg Co, 107 Bruckner Blvd, New York 54, N. Y.*

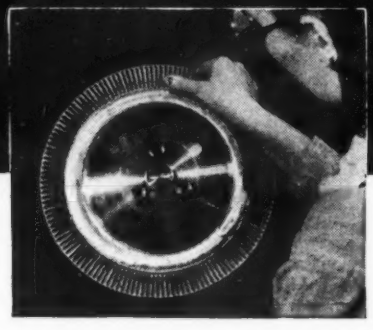
Frequency Relays

NEW RELAY responds to change in frequency. It uses a single electromagnet and has two balanced circuits arranged so that a small change in power factor makes large current changes. This results in a high torque for operating element. When two parts of a power system, joined by a tieline, are separated by loss of connecting line, one section may not have sufficient generating capacity to carry its loads. Relay decreases amount of load dropped on a preselected basis.

CF-1 relay has other applications. For example, some plants have surplus electric power-producing capacity. Surplus power is fed into the local system. When frequency on public-utility system drops, the



Because They Operate Under Severe Conditions



Turbosupercharger Buckets are made from a HAYNES STELLITE Alloy

• Buckets in the wheels of airplane turbosuperchargers are driven by the impingement of exhaust gases at 1,500 to 1,600 deg. F., and rotate at speeds so high that a ½-oz. bucket is subjected to centrifugal force of 750 pounds.

A HAYNES STELLITE alloy is used because it withstands the severe conditions of high temperature, corrosive gases, vibration, and centrifugal stresses over long periods of time. No other economically practical metal has been found for this service.

The same properties that make this HAYNES STELLITE alloy so essential in turbosuperchargers are also important in many other applications where severe conditions of heat and corrosion are encountered.

Consider HAYNES STELLITE alloys for those jobs where other metals fail. Our engineers will help you use them economically and efficiently. Write for further information.

Only HAYNES STELLITE Alloys Offer All These Advantages

1. They resist wear and abrasion.
2. They maintain their hardness even at red heat.
3. They retain their good mechanical properties at high temperatures over long periods of time.
4. They resist atmospheric corrosion and corrosive chemicals.
5. They take and keep a high polish.
6. They have a low coefficient of friction.
7. They are practically non-magnetic.
8. They can be supplied in the form of castings, small sheets, and welding rod.

HAYNES STELLITE TRADE-MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York 17, N. Y. UCC Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

RED-HARD, WEAR-RESISTING ALLOY OF COBALT, CHROMIUM, AND TUNGSTEN.

"HAYNES STELLITE" is a registered trade-mark of the Haynes Stellite Company.

When heat bakes out the insulation on your wiring, power fails and motors stop running. These failures can be serious. Particularly if they occur when plant operations are at peak load. Don't risk power failures with ordinary cables. Rely on a cable that meets the torrid test. Use Deltabeston. It's designed to resist intense heat . . . just the cable you need for power, lighting and control circuits in torrid zones.

The Deltabeston Power Cable illustrated here is a three-conductor Type AVA recommended for installations in conduit or exposed wiring. It is only one of more than a hundred different wires and cables in the Deltabeston line. There's a Deltabeston Cable for every installation where heat, flame, moisture, oil, grease and corrosive vapors are a problem.

Deltabeston Power Cable Types AVA or AVL are ideal for wiring in power plants, boiler rooms, steel mills and in other installations where constant high temperatures prevail. It is insulated with felted asbestos, varnished cambric insert and asbestos braid or lead sheath over-all.

Here's the answer to your wiring problems. You can obtain a copy by writing to Section Y253-52, Appliance and Merchandise Department, Bridgeport, Connecticut. Deltabeston Wires and Cables are distributed nationally by Graybar Electric Company, G-E Supply Corp., and other G-E Merchandise Distributors.

BUY WAR BONDS AND KEEP THEM

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

GENERAL ELECTRIC

plant's relatively small generating system tries to shoulder whole load. Frequency relay enables tieline to be broken to avoid this condition.

Another relay development, which bears on problem of holding together systems with single tielines, is that of selective-pole tripping. System opens two lines if they are involved in 2-phase-to-ground faults or line-to-line faults. This leaves one line tying system together, which although not so effective as two lines reduces tendency for two systems to swing apart in speed before reclosure. Relay selects correct phase or phases to be tripped.

HKB relay determines whether a breaker should open or not by comparing waves at two ends of a line section. It uses one relay for all three phases instead of one for each, and no potential transformers are needed because it requires no voltage discrimination. Relay does not interpret an out-of-step condition as a fault. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Electrical Connector

COMPOSED OF TWO IDENTICAL halves, *Burndy* quick-disconnect clasp for small wires slides together in jack-knife fashion and locks in a positive position with a slight pull. This feature prevents loosening or pulling apart in service. *Burndy* clasp, made of copper and heavily silver-plated, has high electrical efficiency and excellent resistance to corrosion.

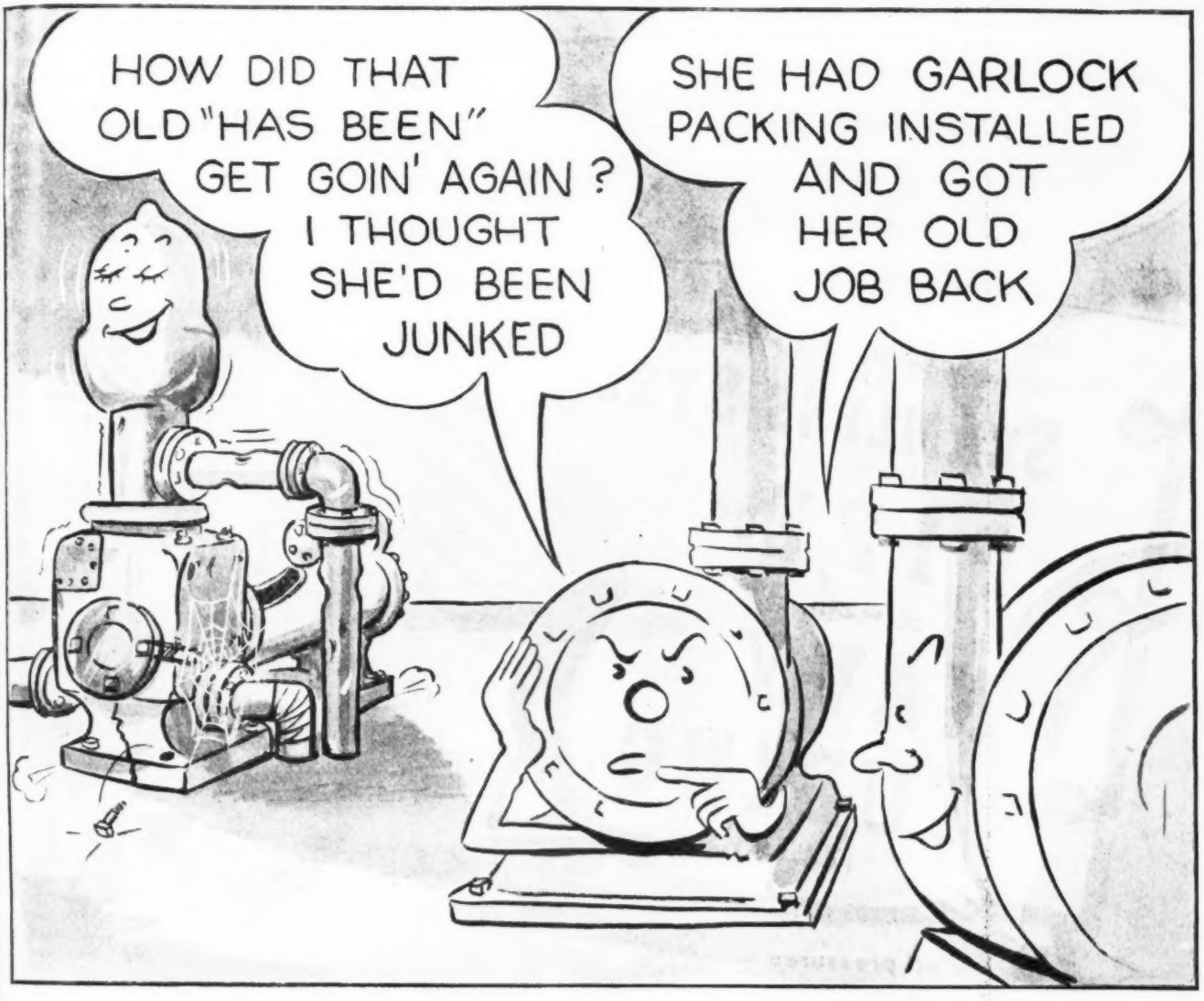
Four connector sizes accommodate ten sizes of aircraft cable. Two smaller sizes include an insulation grip on cable sockets and two larger sizes are without insulation grips. *Burndy Engrg Co,* 107 *Bruckner Blvd, New York* 54, *N. Y.*

Air Cleaner

PRECIPITRON IS IDEAL where ventilating air cannot be changed frequently and/or where oil vapor may be present as carbon dust from brushes of dc machines may accumulate on windings and decrease insulation strength. Based on normal brush wear, electrostatic air cleaner need be cleaned only once or twice a year. Cleaning is simply a matter of flowing water over *Precipitron* plates. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

High-Weighing Capacity Scale

UNIT-WEIGHT CABINET scale has standard *Kron* dial mechanism, swivel head, tare and capacity beams and drop weights to provide high gross-platform capacity. By rotating handle on left of cabinet front from 1 to 7 unit-weight increments, each equivalent to the dial chart capacity, can be added to lever system to increase gross weighing capacity of scale. Weight in-


HOW DID THAT OLD "HAS BEEN" GET GOIN' AGAIN ? I THOUGHT SHE'D BEEN JUNKED
SHE HAD GARLOCK PACKING INSTALLED AND GOT HER OLD JOB BACK

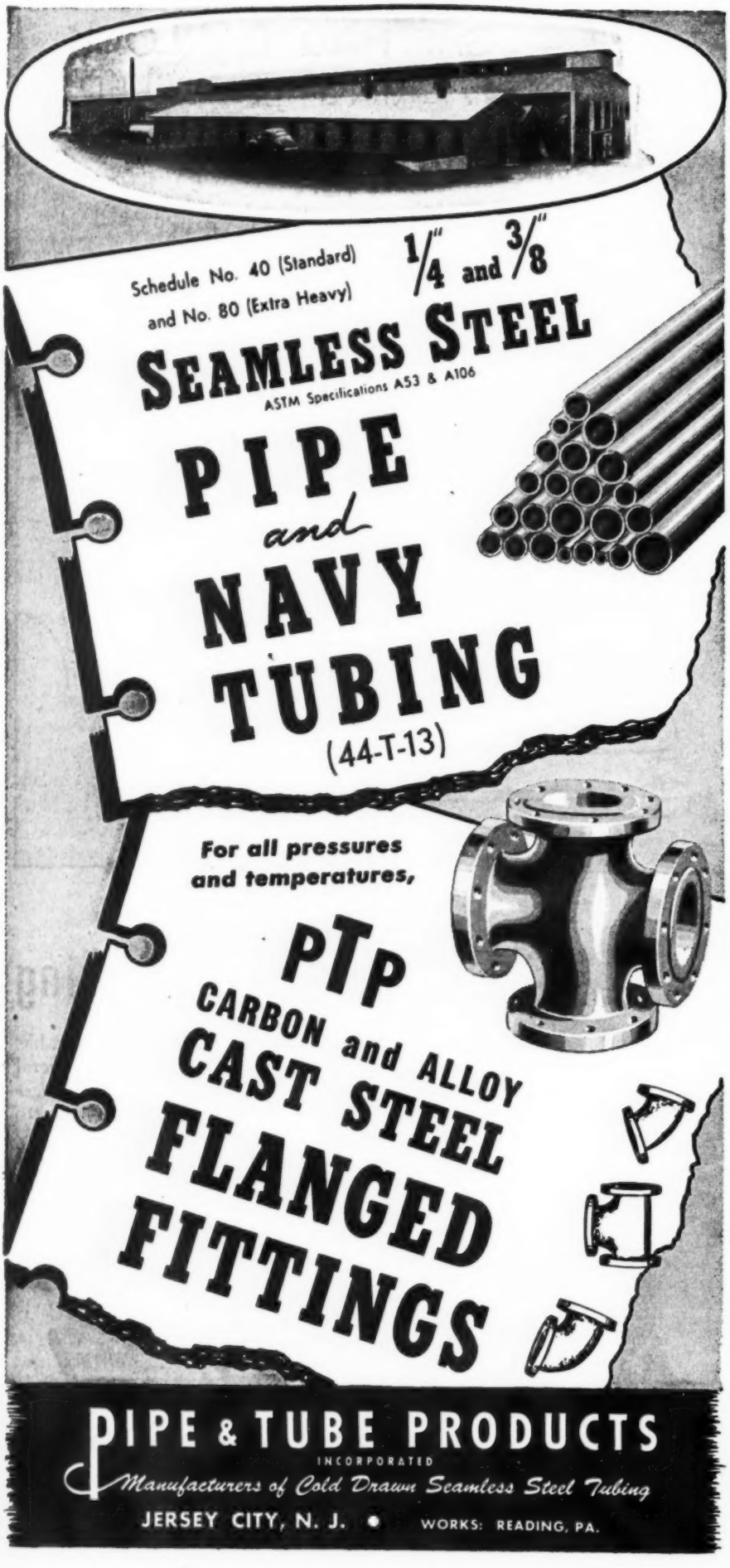
CHEVRON Packing

Yes, Garlock CHEVRON automatic action packing has proved itself on thousands of applications in general industry throughout the country. The unique hinge-like, cross-sectional design allows the packing to expand and contract—*the greater the pressure, the tighter it packs.* You can always depend on CHEVRON for superior performance.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

Garlock



crements are indicated in a target on dial chart as they are added to lever system. Flexible cables connecting this target to drop-weight mechanism allows dial head to swivel to any position. Gross weighing capacity may be increased as much as nine times for heavy-duty service, while still retaining low dial-chart graduations. *Yale & Towne Mfg Co, Philadelphia 24, Pa.*

Oil Concentrate

WHEN ADDED TO or blended with any good grade of oil in correct proportion, *Gibraltar* oil concentrate produces a super-lubricant, according to manufacturer. Concentrate is for all internal-combustion engines. It thoroughly mixes with lubricating oil, will not settle out or segregate and cannot be extracted by any filter. It prevents formation of hard carbon on valves and rings in air compressors and internal-combustion engines. Manufacturer recommends that one part of *Gibraltar* oil concentrate be added to eight parts of regular lubricating oil. *Hood Refining Co, N Hamilton Ave, Greensburg, Pa.*

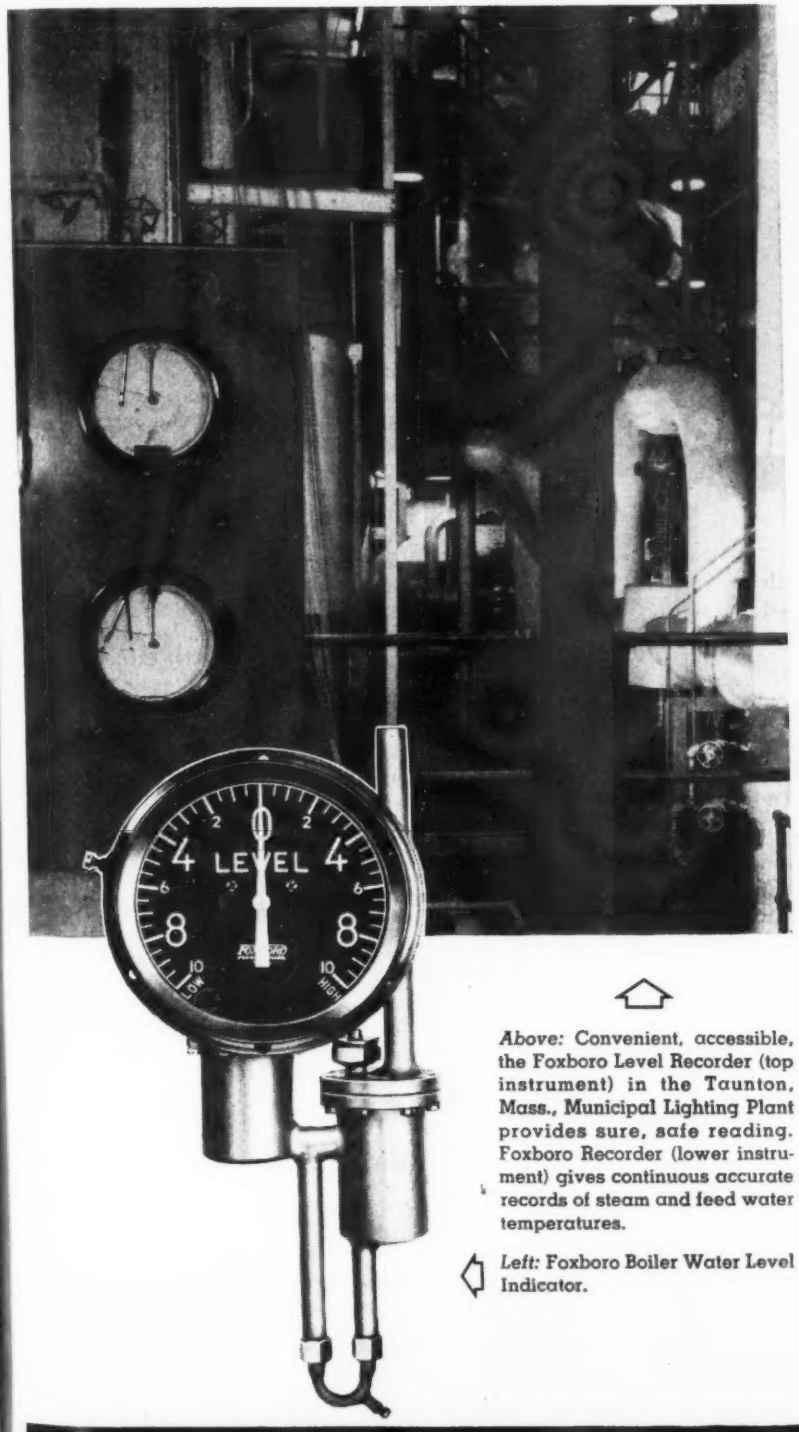
Hose Clamps

STAINLESS-STEEL AERO-SEAL hose clamps are for service where conditions require high corrosion resistance. At present production is only in M12, M16 and M20 sizes, but line will be increased gradually to include all nominal sizes from ½ through 4¼ in. Although lighter and thinner, stainless-steel bands have greater strength and flexibility than carbon-steel clamps and have advantage of being made entirely of rust-resistant material. New mechanically interlocked saddle permits elimination of welds at that vital point. Clamps have all basic qualities of *Aero-Seal* design. *Aircraft Standard Parts Co, 1727 19th Ave, Rockford, Ill.*

Filtration Process

ORDINARY WATER can now be transformed into chemical equivalent of distilled water by a simple filtration process. Principle of the *Filt-R-Stil* is one of filtration by utilization of melamine-derived and other resins. Water passes through beds of these ion-exchange resins, which transform dissolved salts in water to corresponding acids and in turn absorb the acids. Final demineralized water shows an average salts content as low as 2 ppm

They Even Prevent Human Forgetfulness!



Above: Convenient, accessible, the Foxboro Level Recorder (top instrument) in the Taunton, Mass., Municipal Lighting Plant provides sure, safe reading. Foxboro Recorder (lower instrument) gives continuous accurate records of steam and feed water temperatures.

Left: Foxboro Boiler Water Level Indicator.

Foxboro Liquid Level Indicators and Recorders bring boiler-water readings out where they practically can't be overlooked!

Here's a typical example of the engineering thoroughness that goes into the design of every type of Foxboro Instrumentation.

Even the hazards of human carelessness in boiler operation have been foreseen in the design of Foxboro Boiler Water Level Instruments. These safer level gauges are designed for mounting at eye-level in the most-accessible location . . . *where frequent reading practically can't be overlooked!*

What's more, the Indicator has a highly visible dial that shows up clearly in any light where men can work. The Recorder not only permits easy check-up at any instant, but provides continuous graphic records to *prove* whether correct level has been maintained.

Foxboro Boiler Water Level Indicators and Recorders are made for any pressures encountered in modern steam power plant practice. Simply, ruggedly constructed to serve many years without maintenance. No glass to break . . . easily installed without disturbing the gauge-glass. Write for detailed information. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Mass., U. S. A.**

ATLANTA, GA., Room 713, 101 Marietta Street Bldg.

FOXBORO REG. U. S. PAT. OFF.

BOILER WATER LEVEL INSTRUMENTS

We Didn't Want to Make Strainers

BUT we needed them for use with Yarway Steam Equipment and couldn't find any to suit us.

So we designed the *YARWAY Strainer.*

Apparently a lot of other people were having "Strainer trouble" because, without a line of advertising, the Yarway Strainers *purchased* in a few years now number *many thousands.*

Why don't you look into this better Strainer for your money? Buy one from your supply house (over 100 Mill Supply Houses now have them).

See its protection against corrosion—*cadmium plating inside and out.*

Examine its *high grade Monel woven wire screen* that stops dirt—lets condensate or other fluids flow freely.

Notice the removeable blow-off bushing. Screen and bushing come out together—go back together, *automatically aligning.*

Six standard sizes from ½" to 2" for pressures to 600 lb.

See your Mill Supply House or write for Bulletin S-200

YARNALL-WARING COMPANY
100 MERMAID AVE. PHILADELPHIA 18, PA.

YARWAY STRAINERS

(as calcium carbonate) and has been as pure as 0.5 ppm. Process also removes dissolved carbon dioxide from water, a feature of importance in electronic and electrical fields.

Filt-R-Stil is available in portable and stationary models and in different sizes and capacities to meet various requirements. Small portable unit is made in two forms, one for field and the other for bench use. Capacity of these small units is eight to ten gal of demineralized water per hr. They are equipped with cartridges of ion-exchange resins, which are renewable when exhausted. *Filt-R-Stil Lab* unit has a capacity of about 30 gal per hr. Laboratory unit operation differs somewhat from that of portable unit. In place of a cartridge, there are four beds of alternate cation-and-anion-exchange resins in pyrex-glass columns connected by an intricate piping system. As water passes over first bed, dissolved salts are transformed to corresponding acids. These acids are absorbed on second bed. Third bed picks up any dissolved salts which have leaked through and fourth absorbs remaining acids as well as removing carbon dioxide.

In addition to these units, *Filt-R-Stil* is also made in special sizes for large industrial users. Boiler plants, oil refineries, synthetic-rubber plants, textile mills, etc, can thus obtain a continuous supply of demineralized water. Other liquids can be handled in production volume for improved process developments as, for instance, in sugar and chemical industries.

Both the *Lab* unit and large, permanently installed units are equipped with a system for reactivation of ion-exchange resins, which thus can be used again. These units have electronic controls, operating on a resistance circuit in the water which indicates when effluent water is mineral-free and/or when quality is below standard and regeneration is thus required. *American Cyanamid & Chemical Corp, 30 Rockefeller Plaza, New York 20, N. Y.*

Stainless-Steel Tubing

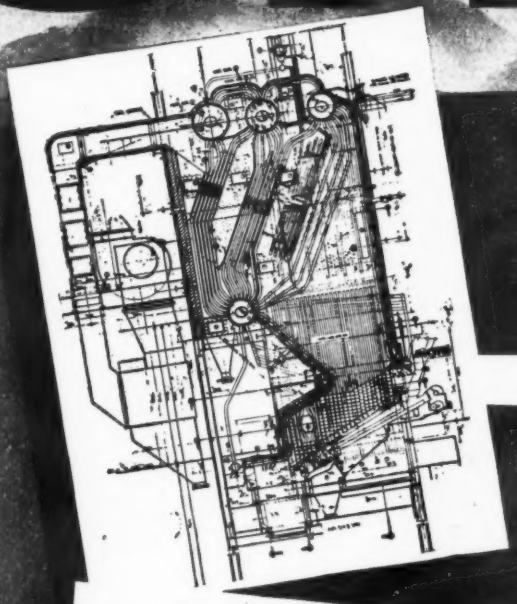
DESIGNED TO MEET many new requirements, 6 in. ID size stainless-steel flexible tubing increases range of *Rex-Flex* sizes from ¼ to 6 in. ID. This makes a total of 16 sizes and five types of wall structure available. *Chicago Metal Hose Corp, 1311 S 3rd Ave. Maywood, Ill.*

Wire Stripper

BRUSH STRIPPER strips and cleans cotton and enamel, silk and enamel, and similar light insulations from round, flat or rectangular wire—solid or stranded. It is especially suitable for cleaning fine *Litz, Formex, Formvar* wire and fiber-glass insulation. Two wire-cleaning brushes are positively driven, being mounted directly on end of separate motor shafts. Right-hand motor is on a pivoted base and is normally held up by a spring. This keeps brushes apart except when stripping wire so that brush life is greatly increased.

To strip wire, simply insert wire in opening and press foot pedal. This brings upper brush down against wire and lower brush. Wire is quickly cleaned between two rapidly

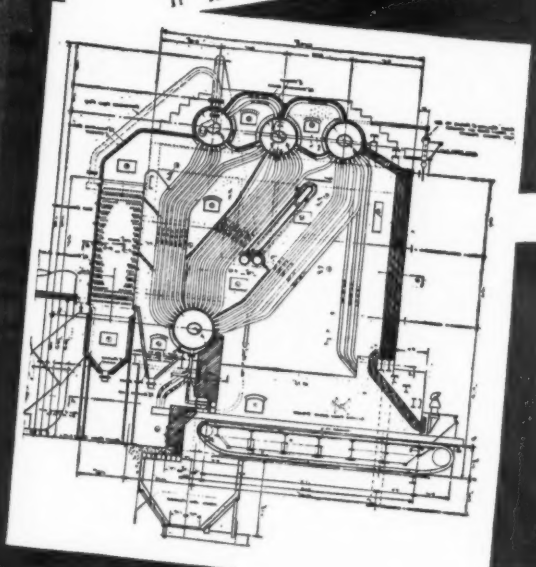
STEAM for



POWER

SOUTHERN COLORADO POWER COMPANY
Pueblo, Colo.

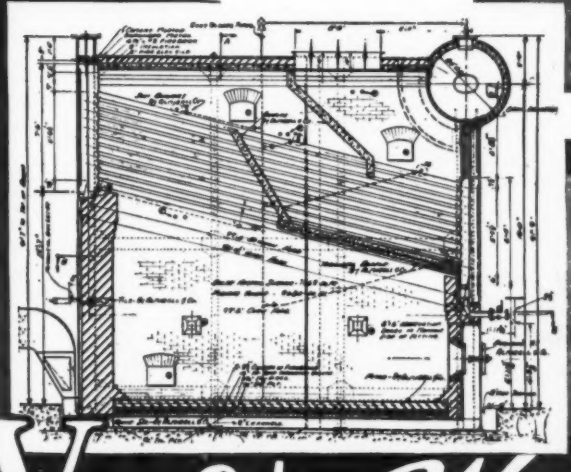
90,000 lbs. steam per hour Vogt LE type bent tube boiler with underfeed stoker. Water walls and economizer. Design pressure 525 lbs. Total steam temperature 750 degrees F.



PROCESS

IN A LARGE MID-WESTERN STEEL MILL

Two 105,000 lbs. steam per hour Vogt LE type bent tube boilers with chain grate stokers and economizers. Design pressure 225 lbs. Total steam temperature 550 degrees F.



HEATING

CRIMINAL COURTS BUILDING AND JAIL
New York City

Four Vogt sectional header type boilers of 47,000 lbs. steam per hour capacity, oil fired. Design pressure 200 lbs.

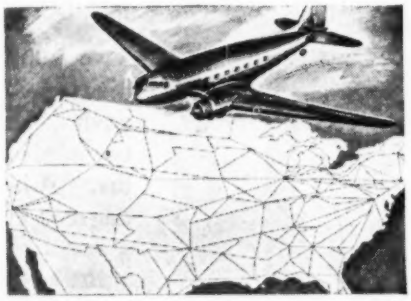
HENRY VOGT MACHINE CO.
LOUISVILLE, KENTUCKY
Branch Offices: NEW YORK CLEVELAND
CHICAGO PHILADELPHIA TULSA

Vogt Water Tube BOILERS
BENT TUBE AND SECTIONAL HEADER TYPES

564 Man-Hours Saved by 6-Hour Air Express Shipment

AIR COMPRESSOR blows out! And 80 highly skilled men in a plant producing radio parts are idle. A phone call to the supplier gets a new unit delivered in six hours flat—via Air Express, the only way to avoid lay-off of the night shift with loss of 564 man-hours. (Air Express can serve every business with economy.)

SPECIAL PICK-UP and delivery of shipments at both ends, with speed of flight in between! The great economy of Air Express must be figured in terms of *time*. When time means money, Air Express saves both.



THOUSANDS of manufacturers have found that Air Express usually saves many times over its cost. (Any item anywhere in the nation is yours in a matter of hours, so long as the shipment fits in a plane.)

Specify Air Express—Low Cost for High Speed

25 lbs., for instance, travels more than 500 miles for $4.38, more than 1,000 miles for $8.75, more than 2,000 miles for $17.50, at a speed of three miles a minute—with cost including special pick-up and delivery in all U. S. cities and principal towns. (Often same-day delivery between airport towns and cities.) Direct service to scores of foreign countries. Rapid air-rail service to 23,000 off-airline points in the United States.

AIR EXPRESS

AIR EXPRESS

GETS THERE FIRST

Write Today for "Quizzical Quizz", a booklet packed with facts that will help you solve many a shipping problem. Railway Express Agency, Air Express Division, 230 Park Avenue, New York 17. Or ask for it at any Airline or Express office.

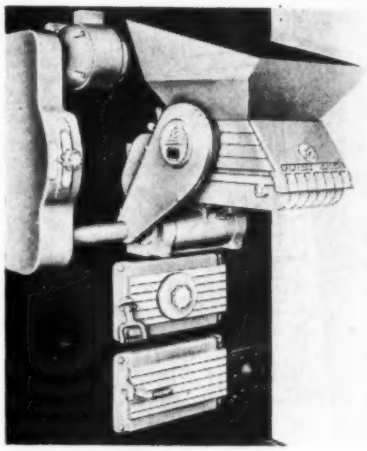
Phone RAILWAY EXPRESS AGENCY, AIR EXPRESS DIVISION
Representing the AIRLINES of the United States

turning brushes. Where desirable, distance between the brushes may be set to wire diameter, thus eliminating foot-pedal action. Brushes are in sections of special steel wire ground to size. Each section is replaceable as it becomes worn.

A dust collector removes strippings, dust and dirt. This is driven by a separate motor, has a dust capacity of 1 cu ft per min and is rated at 60 cfm at .55-in. static pressure. *Ideal Commutator Dresser Co*, 1025 *Park Ave, Sycamore, Ill.*

Electrode Holder

MOR-WELD has a heat-resisting Everlast plastic jaw cover which is said to give longer service than conventional models. This eliminates constant changing of jaw covers as well as handle covers. Its flexibility enables welding rod to be consumed down to a stub without bending. Grip holds all rod sizes. All parts are interchangeable because there are no pins or bolts, which allows for fast servicing and cleaning. Mor-Weld keeps cooler than other models under continuous operation, according to manufacturer, and is for hard service. *Pacific Engrg Corp*, 3123 *San Fernando Rd, Los Angeles* 41, *Calif.*

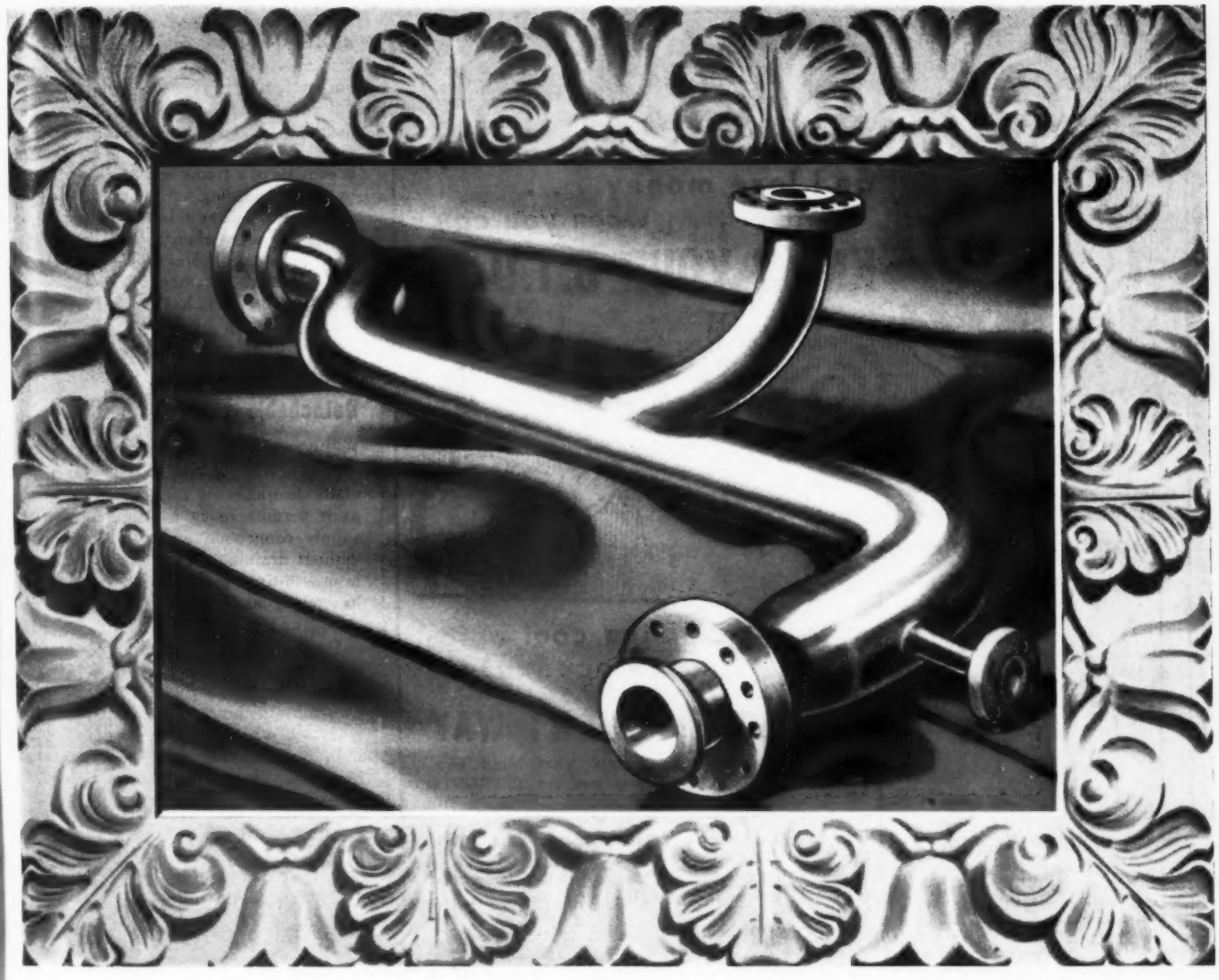


Spreader Stoker

AUTOMATIC STOKER burns all kinds and grades of solid fuels, including wet or dry byproducts and plant refuse. Clean and quiet in operation, *AE Perfect Spread* stoker gets up steam on instant demand with its combination of an all-speed non-clog feed, uniform fuel spread by the overthrow method and thorough combustion through forced draft and grate design. Stoker can be installed easily under most existing boilers to produce steam up to 200,000 lb per hr. *American Engrg Co, Philadelphia* 25, *Pa.*

Vibration Recorder

ABOUT THE SIZE of an ordinary box camera, *Vibrograph* weighs less than nine lb and requires no power connection. This purely mechanical device writes a permanent record of vibrations over a range of 600 to 15,000 cycles per min and amplitudes as low as one ten-thousandth of an inch, or as great as one sixteenth of an inch. The



Pipe Pre-Fabrication is a Fine Art

Modern pipe fabrication is much more than the routine combining of bends, fittings, flanges, welds, etc. It is a fine art requiring a high degree of skill and judgment on the part of many specialists—skill and judgment which come only from long experience.

Engineers must know how to get the desired result in the most economical way—must be able to plan sub-assemblies which are practical and reduce field work to a minimum. Pipe benders must be masters of a difficult art: bending without flattening or wall thinning or metal deterioration. Pressure piping welders must be qualified on different materials and on various procedures. Men who do aligning, heat treating, testing, etc. must all have their special qualifications.

Qualified pipe fabricators have the advantage of permanent organizations containing men who have these qualifications. As a result, piping pre-fabricated by a qualified fabricator is better in quality, easier to erect and insures fulfillment of all intents of the design.

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

G-7

1108 CLARK BUILDING, PITTSBURGH, PA.

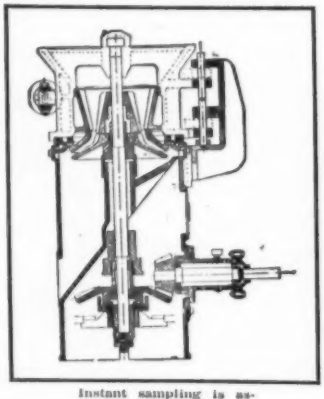
Why guess

at the coal you're using and lose money . . .

. . . when you can

KNOW YOUR B.T.U.'S

save and get maximum plant performance



Instant sampling is assured by the "STURTEVANT"

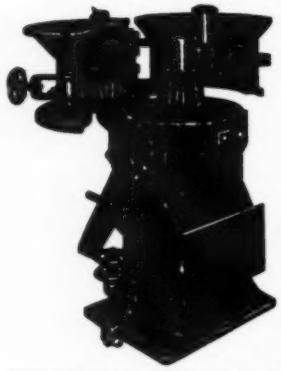
. . . by sampling coal automatically and accurately

THE STURTEVANT WAY

Hit-and-miss inaccurate results from hand sampling are "OUT" when you put the IMPROVED STURTEVANT AUTOMATIC COAL CRUSHER and SAMPLER to work. Not only is limited manpower (for hand sampling) replaced by machine power the "STURTEVANT WAY" but you are assured accurate representative samples that give you constant, true values of the coal you buy and burn.

Now is the time to eliminate guesswork—now when your sources of coal supply are such variable factors and when to "know your B.T.U.S." is so essential to the proper operation of your plant and its uninterrupted service. By eliminating guesswork as to your coal, the "STURTEVANT WAY" provides the means for adjusting your plant exactly to the coal as it is delivered to your bunkers. Now is the time to get the highest return from the dollars you spend for fuel, which today are probably your biggest single item of expense. Now is the time to provide your laboratory with coal samples that when analyzed will give you data from which maximum plant efficiency can be attained.

WITH THE "STURTEVANT", 3" coal samples are crushed to 8 mesh or finer at the rate of 1 ton per hour. Truly representative 5, 10 or 15% samples are taken ready for the laboratory.



Representative samples of coal are obtained by the "STURTEVANT" mechanically in a fraction of the time required for inaccurate hand sampling.

WRITE AT ONCE FOR

a copy of "HOW TO SAMPLE COAL AUTOMATICALLY." It contains important information on how to get the most out of your coal.

What users say

"The crusher gives us a more representative sample of a carload than we could hope for with hand sampling and with less expense."

"The difficulty of getting a laborer to conscientiously follow out the various steps eight or ten hours a day, every day of the week and the "human element" of inaccuracies are all eliminated."

Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston, Mass.

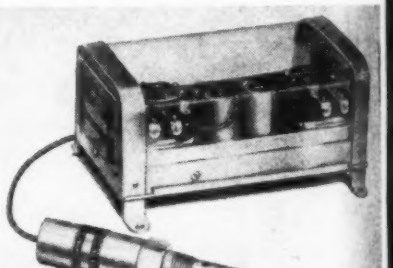
vibration record and a timing wave are drawn on a 1-in.-wide transparent plastic tape, which is viewed by a low-power microscope.

Vibrograph achieves mechanical amplifications of about eight, using same principle by which earthquakes are recorded. It consists of a frame with a mass suspended by a weak spring. A pointer attached to the mass indicates relative motion between frame and mass when frame is applied to a vibrating body. *Vibrograph* makes its mark on the tape either when it rests on vibrating body or when it is held in hand and vibration picked up by a prod. *Westinghouse Electric & Mfg Co, E Pittsburgh, Pa.*

Detachable Fittings

FIG. 922 IS A QUICK-COUPLING elbow assembly with built-in check valve. It is especially desirable for fuel dispensing systems as it permits ready connection of hose to supply connection and easy hose removal without draining or spilling contents. This bronze fitting, made in 4x2 and 4x2½ in., has spring-loaded check valve that is quick acting and tight seating.

Fig 916 detachable pipe cap, made in 4-in. size only, is of three lug type designed for use with Fig. 922 coupling elbow. Lug for attaching a chain enables cap to be attached to elbow for ready use. Sturdily built and of wing design for easy attaching and detaching. *Bowser, Inc, Fort Wayne, Ind.*



Temperature-Regulating Unit

MODUTEMP, a temperature-regulating unit for heating and ventilating systems using motorized dampers for control, employs principle of a gap formed by two electrical contacts, in a mercury thermostat, which control individual relays. Contacts are set to meet temperature specifications and individual requirement range.

When mercury falls below temperature gap, damper motor runs toward heat position and both relays apply electric heat to thermostat to assist mercury to rise again into gap. When mercury enters gap, motor operation stops and heat from No. 1 relay cuts off, slowing down mercury rise. Damper holds this static position until mercury moves out of temperature gap between the two contacts. If mercury rises above gap, damper motor operates toward cool position and No. 2 relay cuts off remaining heat on thermostat, tending to make mercury fall and reenter gap, stopping damper movement.

System may be specified to handle vari-

ANKORFLEX PACKING

SEALS WITH *Finger Pressure*

Attention Engineers: Write today for special Bulletin showing stuffing box details with types to order for hot and cold Water, Steam, hot Gases, hot and cold Oil, Gasoline, etc.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

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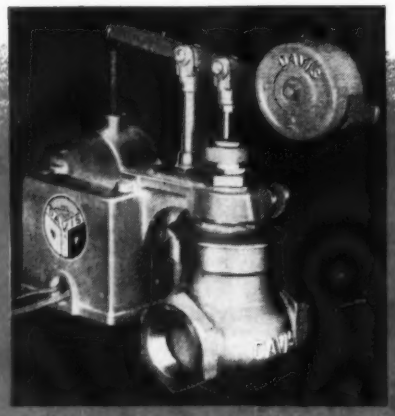
ansas City 6, Missouri 1332 Oak Street
os Angeles 21, California 720 Mateo Street

Montreal, Canada 5575 Cote Saint Paul Road
Milwaukee 2, Wisconsin 903 East Kilbourn Avenue
New Orleans 4, Louisiana 418 Common Street
New York 13, New York 100 Sixth Avenue, near Canal
Philadelphia 8, Pennsylvania 401 North Broad Street
Pittsburgh 22, Pennsylvania 405 Penn Avenue
Portland 5, Oregon Terminal Sales Building
San Francisco 7, California 156 South Park
Seattle 4, Washington 2207 First Avenue, South
St. Louis 3, Missouri 1407 Pine Street
Tulsa 4, Oklahoma 823 South Gary Place
Wilmington, California 524 North Avalon Boulevard



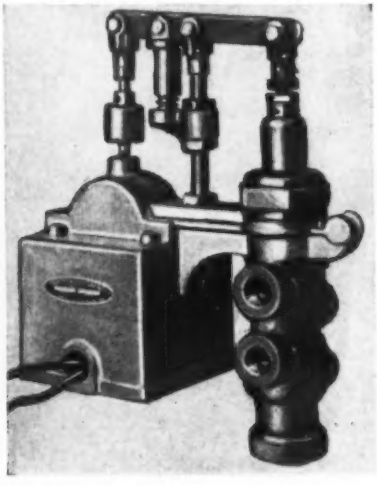
make it Automatic

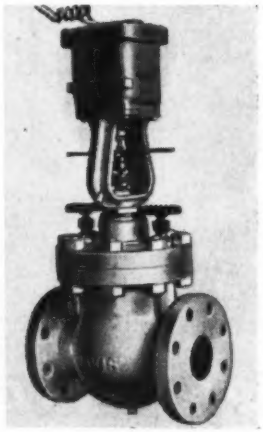
with Davis Industrial Type Solenoid Valves

Freedom from manual control and from fear of disastrous failures is yours when you specify Davis Solenoid Valves. These valves are available for steam, gases and liquids in sizes from 1½" to 12" and pressure to 1500 lbs. Any device capable of making or breaking an electrical circuit will operate Davis valves. Available with either normally closed or open valves, explosion proof solenoid boxes and two step action when extreme accuracy is required.

Wherever an automatic valve will improve your piping system, be sure to write Davis engineers for recommendations. You'll be certain that Davis will furnish the right valve for the job. Informative literature available.

Below—No. 380—a 3 or 4-way pilot valve widely used on air or liquid actuated power cylinders.





Above—No. 93-H with solenoid operated pilot valve and hydraulically actuated main valve built for use on a 400 lb. pressure water main.

DAVIS REGULATOR COMPANY

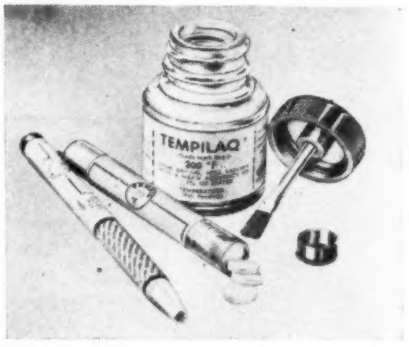
2540 S. Washtenaw Ave., Chicago, Ill.

DAVIS REGULATOR COMPANY

ous motor sizes. Where hydraulic or pneumatic power is used, *Modutemp* controls through solenoid-valve operation. Damper positions at any point necessary to satisfy thermostat and is not limited to steps or set number of degrees of movement. *Vapor Car Heating Co, Chicago 4, Ill.*

Safety Goggle

IMPROVED DURALITE GOGGLE has eyecup which is larger in area and conforms to face more than previous cup, thus providing maximum protection and increasing ventilation and comfort. Cups are nonconductors of heat and electricity and give wider vision angle. Goggle is supplied with either 50 mm Super Armorplate lenses in white glass, or 50 mm in Calobar medium, dark or extra-dark shades. If desired, 6-curve lenses can also be furnished. *American Optical Co, Southbridge, Mass.*



Temperature Indicators

TEMPIL PRODUCTS provide a simple and accurate means of indicating temperatures. *Tempilstik* is for ease, speed and economy in welding, heat treating, general fabrication of metals with overhead, inclined or vertical surfaces. *Tempil Pellets* are for signaling temperatures of extensive areas or large units; for measuring developed heat in engines, motors, gunbarrels, etc; or for other applications where processing must be watched from some distance. *Tempilaq* (liquid form) is useful on interior of tubes and other areas not conveniently accessible to *Tempilstiks*, or pellets, or for glazed or polished surfaces such as glass, plastics, etc.

All are characterized by a sharp and rapid melting action at a given temperature. This shows when proper working heat is reached, or safe temperature limit is approached. All products come in 25-F intervals from 125 to 350 F. *Tempilstik* range continues upward in 50-F intervals to 900 F. *Tempil Pellets* and *Tempilaq* are also in 50-F intervals up to 1600 F. *Tempil Corp, 132 W 22nd St, New York 11, N. Y.*

Power Supply Units

METAL-INCLOSED HIGH-VOLTAGE dc power supply units, in ratings up to 50,000-v dc, provide dc power for electric equipment testing, precipitation, induction heating, radio, etc. Each unit, mounted in a steel cabinet, consists of a full-wave kenotron rectifier, a filter to limit voltage ripple to

IT'S YOUR POSTWAR ELECTRICAL HOME

—See that it works!

THINK of your electrified home to come . . . big and little appliances of all kinds . . . advanced heating . . . air-conditioning . . . better lighting . . . television . . . All fine servants—but they will be handicapped if you give them insufficient electrical capacity.

So often electrical wiring plans are based on *past* electrical experience—a poor guide to the needs of peak loads to come. It's far safer to plan *reserve* capacity in line with the huge future increase in electrical usage. You'll save yourself plenty of grief later in breakdowns and expensive alterations.

Manufacturers! Apply this in terms of industrial equipment in *your* business. The problem's the same. Make sure you have ample electrical capacity to meet the huge future increases in electrical usage sure to come. In plants too, planned wiring will cost a lot less than unplanned wiring.

Before structures get out of the planning stage, it will pay to consult electrical contractor, utility power engineer, plant power engineer. They'll agree that it's always wiser to *Wire Ahead!* 44265

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

ANACONDA

It's Always Wiser to TELEGRAM WIRE TELEGRAM AHEAD

HEAT TRANSFER PRODUCTS

INCORPORATED

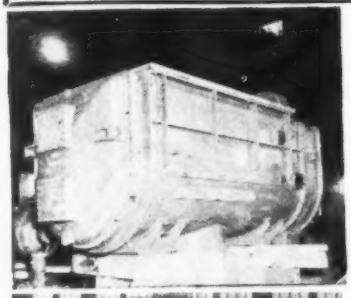
ENGINEERS — **MANUFACTURERS**

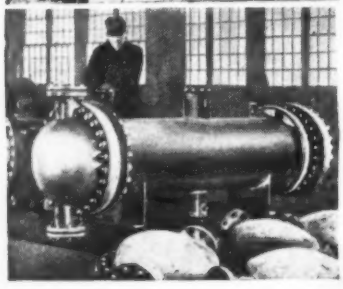
90 West Street — New York 6, N. Y.

West Coast Representative

Harry W. Parsons, Inc.

260 California St., San Francisco 11, Cal.





STEAM JET AIR EJECTORS

●

STEAM CONDENSERS

●

EVAPORATORS

SELF DE-SCALING

(Patented)

VERTICAL COIL TYPE

●

DISTILLERS

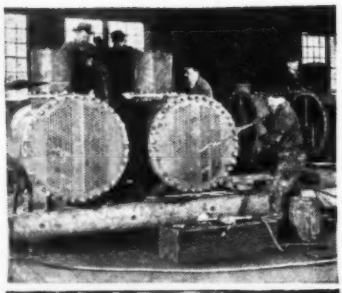
HTP

●

COOLERS

FRESH WATER

LUBRICATING OIL



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FUEL OIL HEATERS

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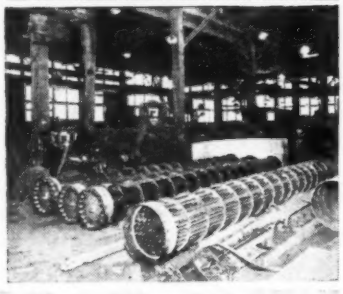
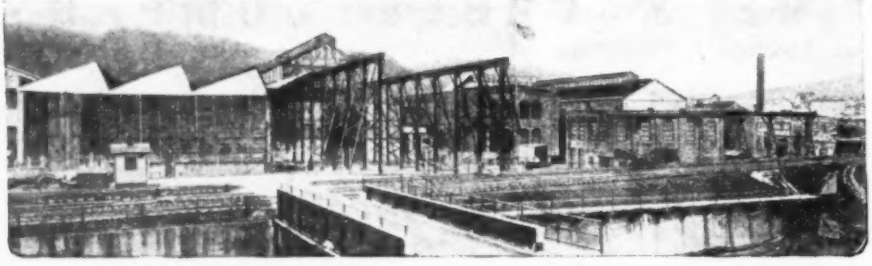
FEED WATER HEATERS

LOW PRESSURE HIGH PRESSURE





PLANT AT CARBONDALE, PA. (90,000 Square Feet)

1% or less and complete control equipment. Output voltage can be controlled, from zero to maximum, by a motor-operated, dry, variable autotransformer.

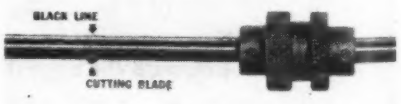
Steel cabinet has dust filters to prevent accumulation of dust and dirt and interior is ventilated by an air-circulating fan. Cabinet can be furnished on a 4-wheel dolly truck.

Automatic solenoid-operated discharge switch interlocks with main supply so that it automatically short circuits the rectifier and discharges filter capacitor through a resistor when power is removed. Safety interlocks automatically de-energize equipment when cabinet doors are open. *General Electric Co, Schenectady 5, N. Y.*

Filter and Weatherhood

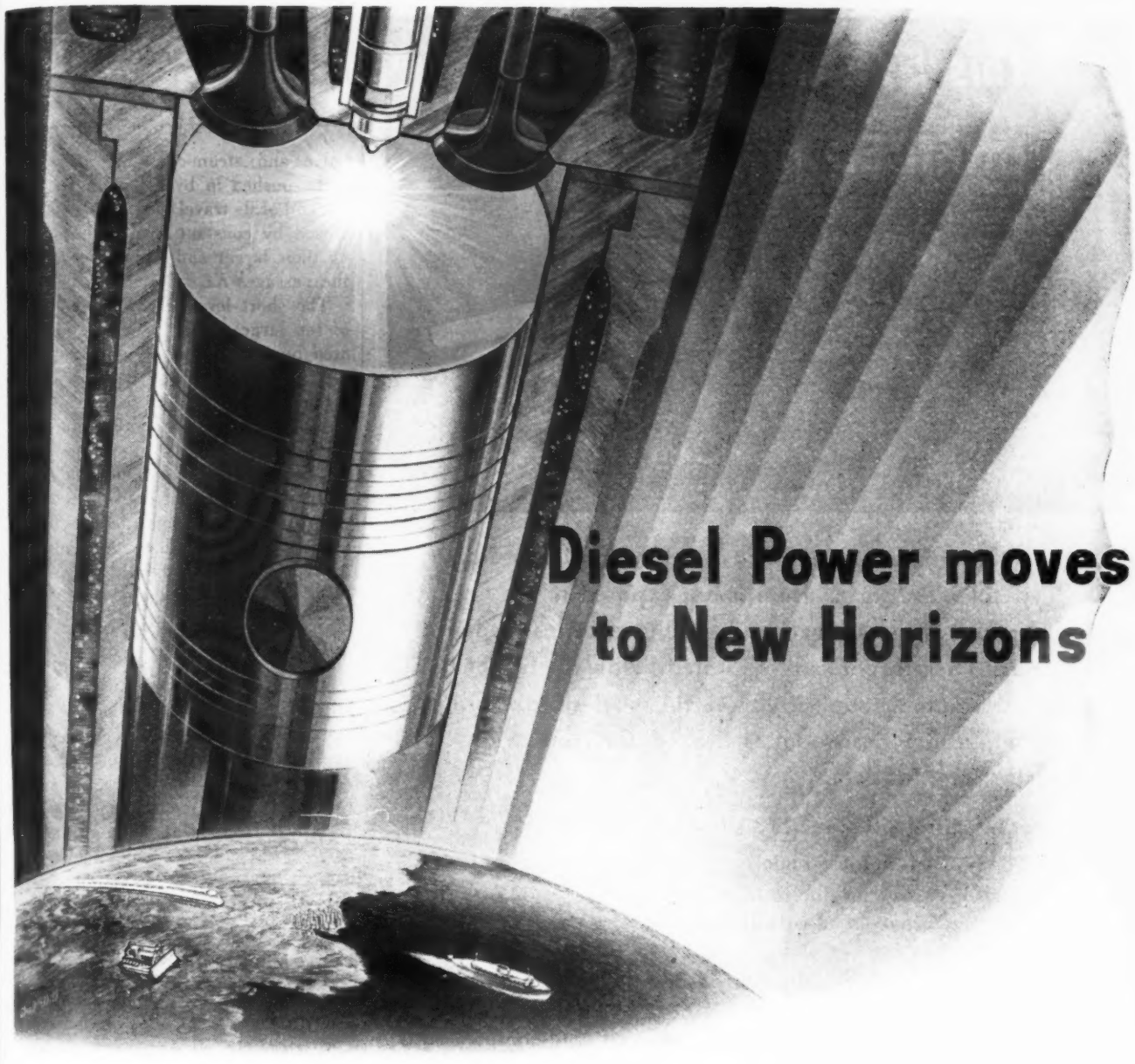
WHEN INSTALLED on a generator welding unit, Badger filter stops process and atmospheric dust, grit, mill scale, welding slag, foundry sand and other particles harmful to moving parts. It is claimed that this filter avoids many expensive repairs, assures longer brush life, minimizes welder shutdowns, lost labor and production time, increases rotor life and helps maintain a constant arc.

Snap-locked easily to position or filter unit, weatherhead is suitable for outside installations or where welders are subject to heavy moisture. It is said that hood keeps snow, sleet, rain or atmospheric and salt moisture out of machine interior. *Badger Corp, E Brown St, Milwaukee 12, Wis.*



Burr-Removing Tool

NOBUR TOOL removes all burrs and sharp edges around inside of holes, of either single or multiwalled parts. It was found that putting an engraved black line around shaft circumference increased efficiency, ease and speed with which each tool could be used. Placed around shaft at a point indicating cutting blade center, this black line provides a clear marking for position of work piece when burring. *Nobur Mfg Co, 910 N Orange St, Los Angeles, Calif.*



Diesel Power moves to New Horizons

Tomorrow, Diesel Power will speed commerce around a shrinking globe and lift century-old burdens from the backs of millions.

For our Diesel industry has grown tremendously in the past decade. The lash of war has further stimulated its growth. Tomorrow, Diesel's inherent advantages of economy, high power-output, durability, versatility and ruggedness will be more widely available than ever in history.

America's engine builders have long since learned to come to American Bosch for the engineering skill to apply fuel injection equipment to ever-improving Diesels. Here they also find the New England craftsmanship to meet unheard of demands for precision production in quantity.

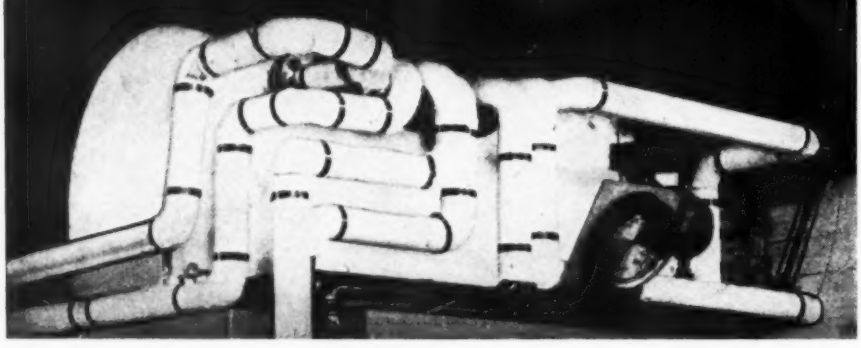
These twin skills have come to be known as "Precision Production for Power." Perhaps better than any other, that phrase describes the American Bosch of today and tomorrow.

AMERICAN BOSCH CORPORATION • ***Springfield 7, Mass.***

AMERICAN BOSCH

PRECISION PRODUCTION FOR POWER

This STEAM DRUM *is an* UNFIRED *pressure vessel*



IN THE International-LaMont Forced Recirculation Boiler, Type LFS, the steam drum is not exposed to the fire or heated gases. No steam generating tubes are expanded into the drum. Therefore it can be located below the top of the boiler structure or supported on the wall of the boiler room, where the headroom is limited for connections to the main steam header.

Other distinctive Type LFS advantages are:

The boiler is in full circulation from zero to maximum load.

Higher efficiencies due to maximum radiant heat absorbing surface in furnace water-walls and effective arrangement of secondary heating surfaces.

Extreme flexibility—follows swinging load from no load to maximum load instantaneously.

Steady water line and dry steam under all load conditions.

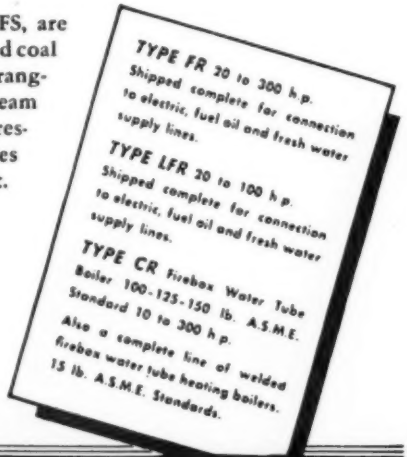
Minimum space requirements—low headroom a feature.

Shop tested sub-assemblies permit quick erection on the job.

International-LaMont Boilers,* Type LFS, are designed for firing with oil, gas, pulverized coal or stokers. They are available in sizes ranging from 4,000 to 30,000 pounds of steam per hour and in all standard working pressures. Larger sizes and special pressures or superheat requirements on request.

Write today for bulletin illustrating and describing special features of this Type LFS Boiler.

*Licensed under LaMont patents.


TYPE FR 20 to 300 h.p.
Shipped complete for connection to electric, fuel oil and fresh water supply lines.
TYPE LFR 20 to 100 h.p.
Shipped complete for connection to electric, fuel oil and fresh water supply lines.
TYPE CR Firebox Water Tube Boiler 100-125-150 lb. A.S.M.E. Standard 10 to 300 h.p.
Also a complete line of welded firebox water tube heating boilers. 15 lb. A.S.M.E. Standards.

Boiler Builders for 59 Years

THE INTERNATIONAL BOILER WORKS CO.
POWER DIVISION
200 BIRCH STREET EAST STROUDSBURG, PA.

Questions and Answers

(*Continued from page* 122)

valve and steam-chest cover. Except when pushed in by the main piston at the end of its travel the tappets are kept closed by constant live-steam pressure on their larger ends, conveyed through the passages *KL* from the steam chest.

The short lever shown in the center of the large piston valve can be operated by a similar lever on the outside of the steam chest. It is used to start the pump if it happens to stop with the piston valve and slide valve exactly on center.

These valves do not have to be set as they are operated entirely by steam pressure and are not attached to any moving pump part. They must, however, be kept well lubricated because of their large area of rubbing surface.

Q 21. *Explain the operation principle of a centrifugal pump.*

A—In a centrifugal pump, one or more revolving wheels, called *impellers*, are attached firmly to a central shaft and surrounded by a stationary casing. As these impellers revolve, water enters at the center from the suction line and is thrown outward by centrifugal force. Water leaves the impeller rim at high velocity, and this velocity is converted into pressure in the surrounding casing or by *diffusion* rings surrounding the impeller. In a single-suction pump, water enters one side of the impeller only. In a double-suction pump, water enters the impeller on both sides.

If a centrifugal pump contains only one impeller it is a *single-stage* pump. If it contains two impellers it is a *2-stage pump*, and so on. Multi-stage pumps are constructed with as many as ten stages. Single-stage pumps are used mainly for pumping against low heads and moderate pressures although improvements in design have greatly increased the range of this pump. In the multi-stage pump, delivery from the first stage passes to the suction of the second stage and is delivered from the second-stage impeller at an increased pressure. In this way pressure is boosted in succeeding stages so that the more stages used, the higher will be the final pressure. In practice, the maximum number of stages that can be used is limited by mechanical difficulties of construction.

Q 22—*Describe construction of the impellers in centrifugal pumps.*

A—Fig. 7 shows two common types, the *closed* and the *open* impeller. The

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Honan-Crane oil purification equipment is sold ONLY by trained Oil Purification Engineers—skilled technicians capable of making an intelligent analysis of any problem involving dirty or contaminated oils. These men are also capable of supervising the proper installation of Honan-Crane equipment to give you maximum oil purification protection against acids, sludges, abrasives, other damaging contamination.

Keeping oil clean pays big dividends in reduced maintenance and increased production in the operation of Turbines, Internal Combustion Engines, Hydraulics, Machine Tools, Compressors and other industrial equipment. Put this Honan-Crane Oil Purification Engineer to work on your problem—he will be one of the most important men in your plant. A Honan-Crane Engineer will call at your convenience. Write today.

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1200 SIXTH STREET LEBANON, INDIANA

Honan-Crane has had more than 20 years of experience in engineering and building oil purification equipment.

closed impeller has a plate or *shroud* on each side of the vanes, whereas the vanes of the open impeller are not in any way closed in. Side plates of the closed impeller direct the flow and thus make it more efficient than the open impeller for pumping clean water. But the open unit is better for handling thicker liquids such as heavy oil, sewage or water containing a great deal of dirt or sand.

Q 23—*Explain how the turbine and volute principles are used in centrifugal-pump design.*

A—In the turbine centrifugal pump, the impeller is surrounded by a stationary diffusion ring containing passages of gradually increasing cross-sectional area. Water leaves the impeller rim at a high velocity, which is converted into pressure as the water passes through the diffusion ring. The casing surrounding the diffusion ring is usually circular in shape and of constant cross-sectional area.

In the volute pump no diffusion rings are used, but the casing is volute in shape, that is, of gradually increasing cross-sectional area so that as the water flows in the casing its velocity is reduced and its pressure increased.

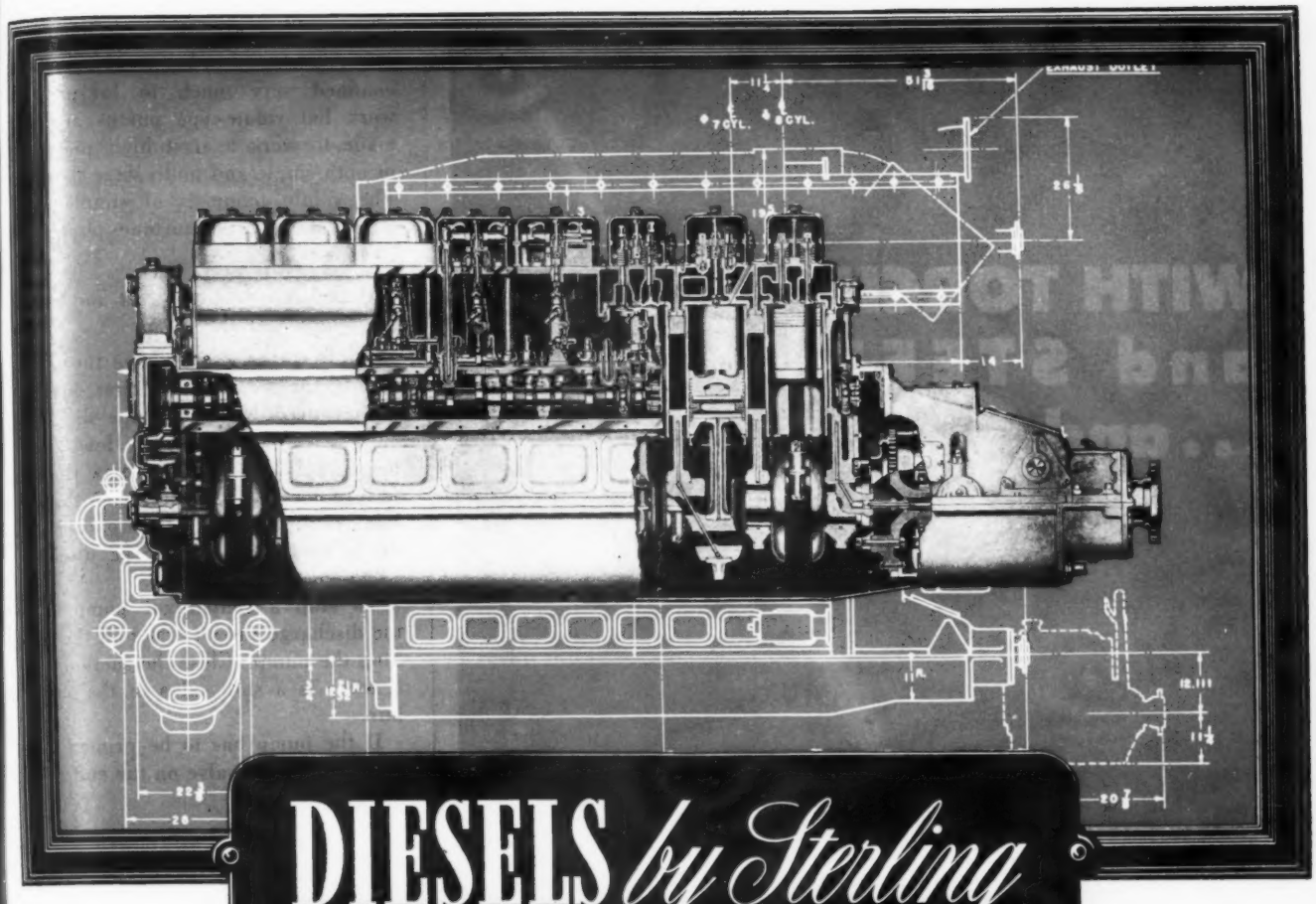
Q 24—*Sketch and describe a centrifugal pump using the turbine principle.*

A—Fig. 8 is a sectional view of a 3-stage centrifugal pump having two turbine stages and one volute stage. The discharge from the last impeller flows directly to the discharge and the use of a final volute stage simplifies construction to quite an extent.

As the impellers are all single suction, the end thrust is considerable. It is opposed by water pressure acting upon the balance drum in the last stage and any excess end thrust acting in either direction is taken care of by a center collar type Kingsbury thrust bearing. The other bearing is the ring-oiled type.

Q 25—*Sketch and describe a centrifugal pump using the volute principle.*

A—Fig. 9 shows a sectional view of a single-stage double-suction volute pump. In this pump no diffusion rings are used, but the velocity of the water leaving the impeller is converted into pressure in the volute casing. The hydraulic balance is practically perfect in this pump because of the double suction and direct flow to the discharge, so end thrust is negligible. The shaft is supported by ball bearings, one being fixed and the other free to move a little endwise and thus take care of any slight changes in shaft length that



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PRODUCTION of the new Sterling Viking Diesel engine is so geared now that almost immediate deliveries are available. Write us for full details of this new power plant for marine or industrial use which gives you the compactness of a gasoline engine of the same power rating plus the economy of diesel fuel. Other Sterling engines—six or eight cylinders—gasoline or gas from 85 hp. to 1800 hp.

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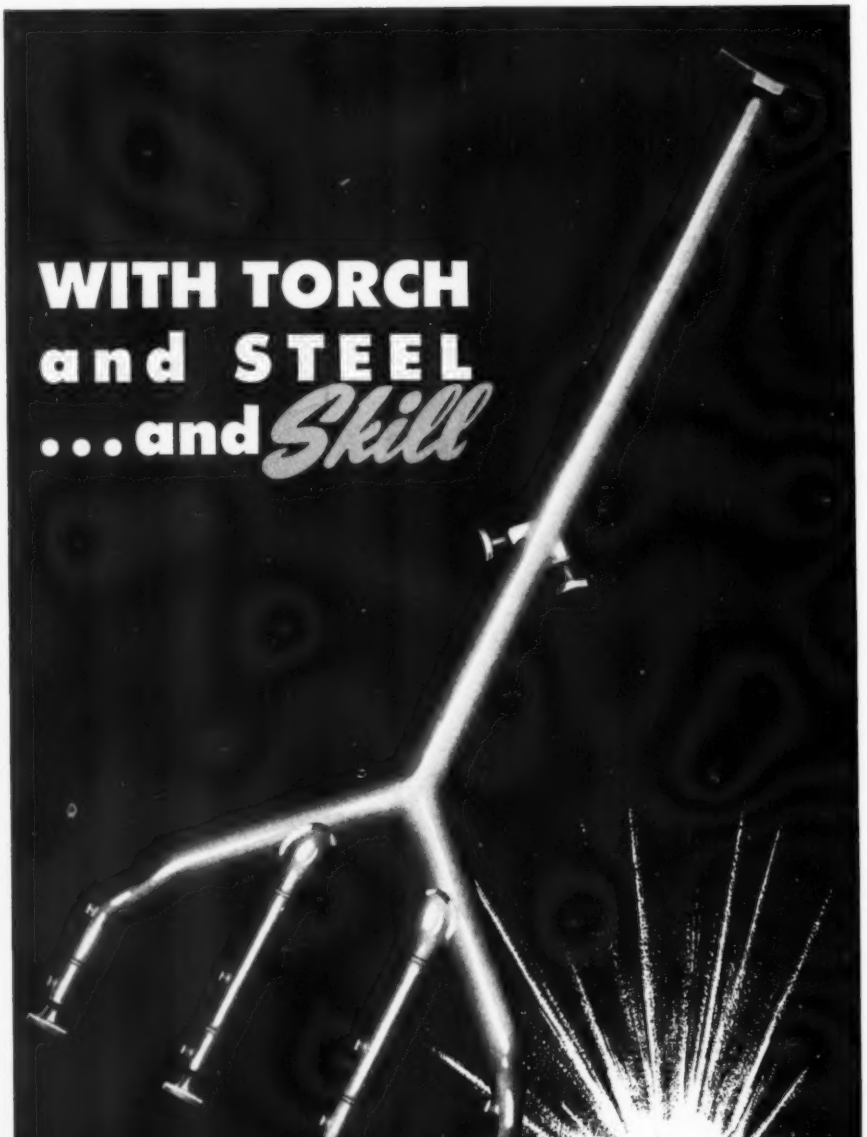

One of the important factors in the development of modern science and industry is industrial piping. Keeping pace with the conceptions and requirements of engineering has been the responsibility of fabricators. Since pipe fabrication is our business, we of Associated have constantly studied and striven in the improvement of techniques and procedures. With torch, steel and skill, and use of finest equipment this firm goes forward... We would like to help with your piping requirements.

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ASSOCIATED *Progressive* **PIPING**

result from expansion or contraction.

Use of volute pumps was formerly confined very much to low-pressure work but volute-type pumps are now made to work against high pressures, in both single and multi-stage patterns. The volute pump is of simpler construction than the turbine pump and has fewer parts.

Q 26—*How do you start and stop a centrifugal pump?*

A—If the pump is above the water-supply surface, prime it first, bring it up to speed, then open the discharge valve gradually to put the load on by degrees. If the pump is below the surface of the water supply, open the suction valve, start the pump, bring it up to speed, then open the discharge valve gradually.

To stop a centrifugal pump, close the discharge valve to take off the load. Stop the pump. Close the suction valve if there is a stop valve in the suction line.

If the pump has to be primed there should be a foot valve on the end of the suction line.

This is the end of the Q and A series by Alex Higgins. See note on page 114.

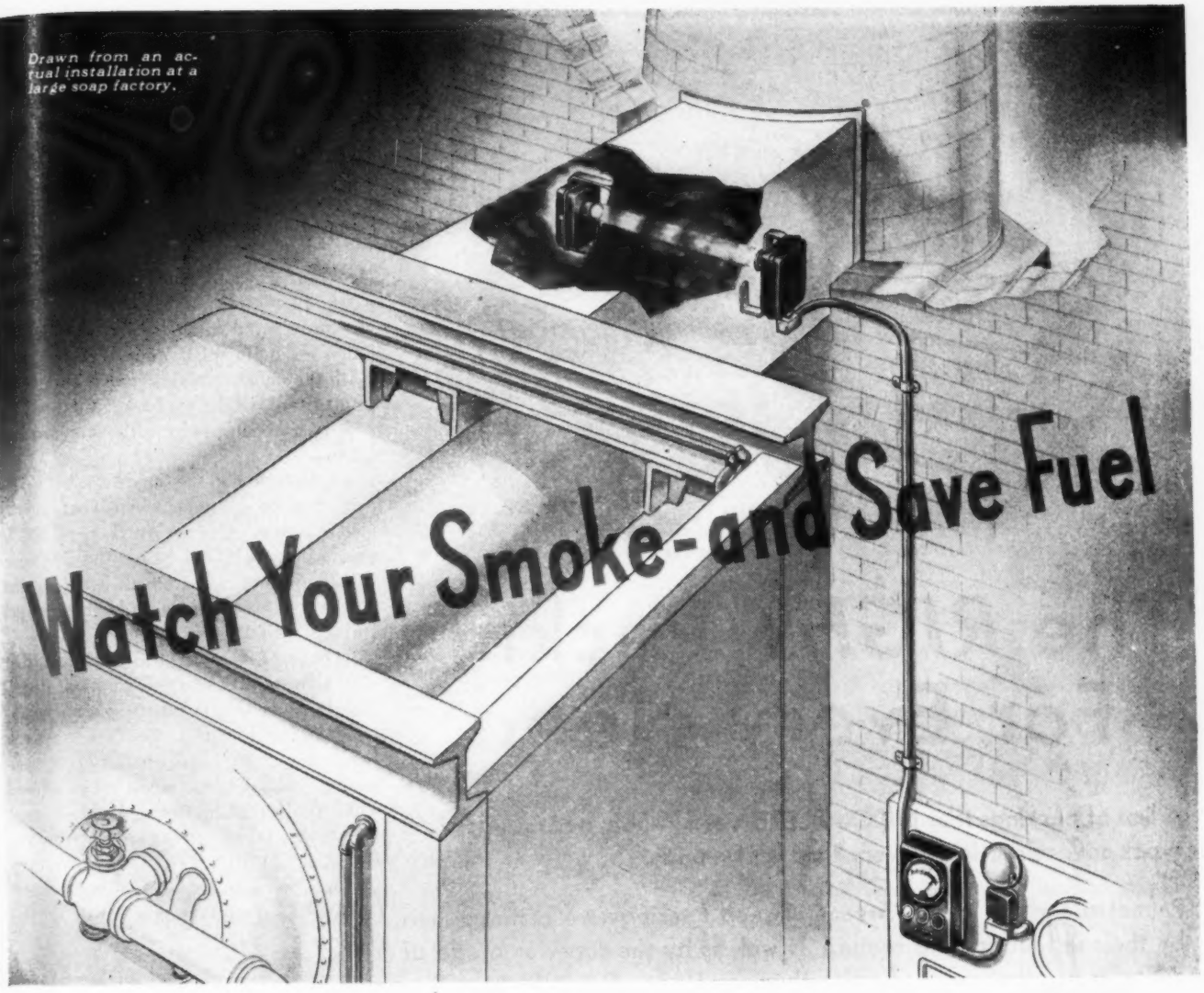
License for York Haven Hydroelectric Project

Federal Power Commission authorized a Federal license for a period terminating in 1970 to the Metropolitan Edison Co, Reading, Pa., for operation and maintenance of the York Haven hydroelectric project across Susquehanna River at York Haven, Pa. Development includes a main dam about 4970 ft long and 10 ft high, a secondary dam and powerhouse containing 20 main generating units which have an aggregate installed capacity of 19,620 kw.

Construction was begun about 1901 and first portion was put into operation in August 1904. After last unit of the dam across main channel of Susquehanna was completed in 1914 no major construction was undertaken until 1918, when construction of a secondary dam, across east channel of river, was begun.

Commission authorized the issuance of a license for 32 years, effective Jan. 1, 1938, subject to the usual rules and provisions of the Federal Power Act and to certain special provisions relating to navigation.

In preparation for substantial increases in postwar employment and production on *Janitrol* heating equipment, Surface Combustion purchases the building adjacent to its Columbus, Ohio, factory. Building is the former Lamneck Products, Inc, factory, which will be altered and connected with Surface Combustion by inclosing connecting areaway.



Too much smoke means waste — brands your plant a community nuisance. Too little may indicate an even greater loss in potential heat. You can guard against this needless waste — assure combustion efficiency — with Photoswitch Smoke Control System.

The vigilant "eye" of Photoswitch photoelectric control scans the smoke, never relaxing for a second its 24-hour watch over your fuel budget. Conditions of excess smoke, normal combustion, and excess air are thus detected *electronically* and reported to the boiler room by means of visual or audible signals, Ringelmann-calibrated meter readings, or permanent chart recordings. The result — a co-ordinated, complete system for checking overall combustion efficiency — simple, dependable and inexpensive to install and to operate.

* * *

Photoswitch is putting electronics to work — today — maintaining boiler water levels automatically . . . controlling levels in condensate return systems . . . detecting contamination in condensate . . . preventing explosions caused by flame failure . . . checking turbidity in liquids . . . timing for split-second repeat-cycle accuracy. Let us recommend the modern electronic solution to your control problem.

Your fuel supply is a share in one of America's vital war resources. Let your smoke stack show you are conserving it accordingly.

A new 8-page bulletin is available to companies interested in smoke control economy. Write to Photoswitch Incorporated, 77 Broadway, Cambridge, Massachusetts, and ask for Bulletin B-12.

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A line of packings that is COMPLETE, yet SIMPLE; because its eight types cover practically every fluid and service.

Palmetto and the other Greene, Tweed Packings are distinguished by their self-lubricating feature as well as by the superior grade of asbestos or other yarns of which they are made. The self-lubricating quality is developed by an exclusive manufacturing process, in which each separate strand is saturated with a special lubricant, compounded for each specific service, and impregnated BEFORE braiding, plaiting or twisting.

This is why you can depend upon extra-long service, with minimum friction and maximum protection to rods, shafts and stems, when you use Greene, Tweed Packings.

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PALMETTO for steam, hot water, air.
PALCO for water. PELRO for oils. CUTNO for alkalis.
SUPERCUTNO (blue asbestos) for acids. KLERO for foods.
Self-Lubricating **PACKINGS**

Power News

(*Continued from page* 130)

SFA to ask whether War Production Board should compile a list of priority customers for this fuel, without which coking, gas and many chemical plants cannot operate. No such priority list is anticipated immediately, the disposition of both WPB and SFA being to fill the most pressing needs first and substitute coals of lesser quality for users who can get by without byproduct fuels.

Attempts will be made to bring all *must* users of byproduct coal up to 30 days' supply by April 1. This, it is anticipated, will cause the diversion of byproduct coal from those users who have large stockpiles and who can get along with lesser fuels.

Office of War Utilities declared that SFA's realization of the position of railroads and electric utilities is encouraging and is based on the fact that each industry must keep operating at sufficient capacity to meet all war and essential civilian needs, which in most instances means *at capacity*. However, electric utilities, averaging 80 days' supply of coal nationally, must expect stockpile drawdowns, at least in byproduct coals.

Directive Issued

One such directive already has been issued, affecting industrial users of coal mined in Indiana, Illinois and western Kentucky who have from 91 to 120 days' supply on hand. Those with more than 90 days' supply will be allowed to purchase only 80% of their monthly burn, while those with more than 120 days' will be allowed to purchase only 60% monthly.

Another directive is expected to be issued shortly requiring New England coal dock operators to ship first to users having less than 30 days' supply. However, relatively few electric companies in New England buy from dock operators.

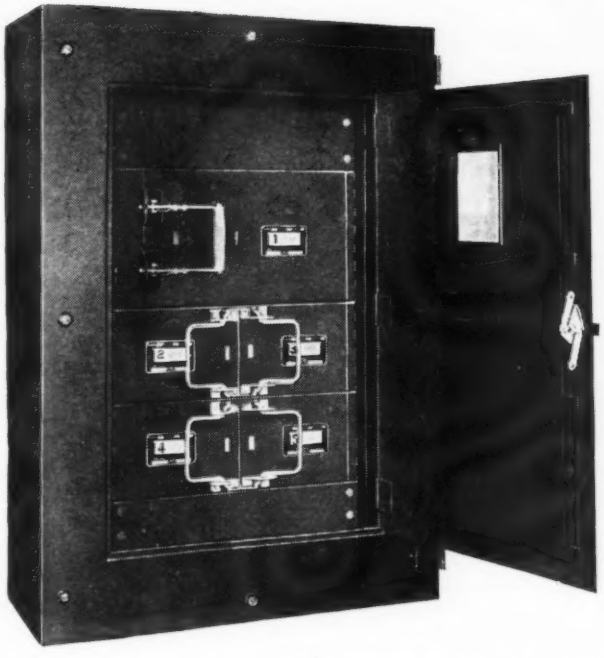
Exceptions to Petroleum Distribution Order 13, under which oil is being made available to East Coast power plants whose capacity could be replaced by coal-fired capacity, are expected to be continued as long as possible despite the increasing shortage of residual fuel oil.

Military demands for oil and petroleum products to be used in Europe will govern the availability of fuel oil for generation.

(*Continued on page* 190)

Saflex DISTRIBUTION PANELBOARDS

for safe, flexible control of electric service and feeders supplying current for power and light

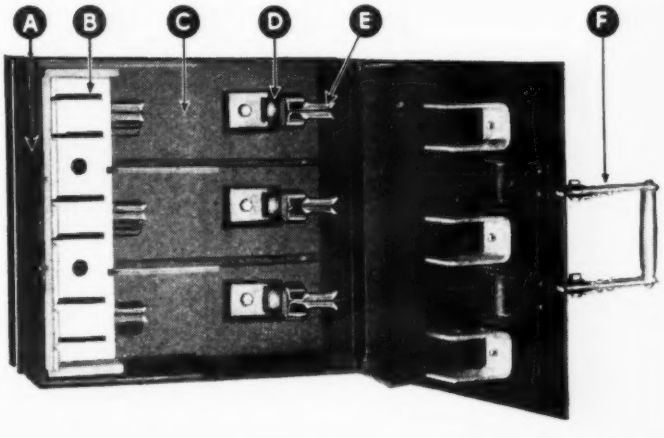


At lower right: *notice the exceptional simplicity and sturdiness of design and construction of Saflex switch units. Ranging from 30 to 600 amperes, they are for use in systems up to 575 volts A. C. or 250 volts D. C.*

A Cover can be locked in either the ON or OFF position by means of a padlock on the bracket. **B** Arc suppressor block greatly increases the rupturing capacity. **C** Shatter-proof insulating base is mounted in steel box for maximum mechanical protection. No molded parts are exposed when cover is closed. **D** Solder-solderless lugs can be used either as solderless connectors or as solder lugs or both. Furnished on all except 30 ampere, 250 volt units. **E** Positive pressure fuse clips have high conductivity and assure automatic contact pressure at the fuse terminals without auxiliary parts. **F** Cam-action provided by handles near switch jaws where it is most needed. This cam-action supplies (with minimum manual effort) the considerable force necessary to provide high contact pressure.

• Saflex units are safe to operate. No live parts are exposed and all circuits may be opened safely under maximum load. The double-break switch jaws are visible for inspection when the unit door is open. The switch blade assembly is the only part carried on the permanently anchored door. All poles are broken simultaneously with no possibility of causing single phasing. Rotary switch blades are provided on all units except 600 ampere size. The cabinet doors are equipped with Yale cylinder locks which prevent unauthorized access to the panel. The box has over-size wiring gutters. The interior, front and box are separate units. Thus, the box can be shipped alone and roughed-in during the early stages of construction, with the interior and front following at a later date.

***See our catalog in SWEET'S or write for Bulletin 2500. Address* Square D Company, 6060 Rivard St., Detroit 11, Michigan.**



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These NEW Catalogs, Booklets and Bulletins Are Yours for the Asking!

BOILERS AND AUXILIARIES

1 OIL BURNERS — Peabody Engrg Corp, 580 Fifth Ave, New York 19, N. Y. 4-page bulletin No. 802 describes mechanical features of Type M oil burner for natural- or forced-draft operation and for use with Peabody atomizers.

2 STEAM GENERATOR—E Keeler Co, Williamsport, Pa. 28-page bulletin No. F12 discusses CP steam generators. Representative list of users is included.

3 SOOT CLEANER—Sterling E Norcross, 35 Walnut St, Bloomfield, N. J. 4-page leaflet presents Kleen-Soot, a soot and slag cleaner.

4 STOKERS — American Engrg Co, Philadelphia 25, Pa. 8-page bulletin describes AE stoker, with photographs, cross-sections and drawings. 20-page booklet shows operating views and drawings of Taylor multiple-retort underfeed stoker.

5 STEAM GENERATORS — International Boiler Works Co, E. Stroudsburg, Pa. 6-page folder covers construction, performance and maintenance of Type LFS International-LaMont steam generators.

ELECTRICAL EQUIPMENT

6 HIGH-VOLTAGE EQUIPMENT—General Electric Co, Schenectady, N. Y. 4-page bulletin No. GEA-4317 contains information on high-voltage metal-inclosed dc supply equipment.

7 ELECTRICAL SWITCHES — Automatic Switch Co, 41 E 11th St, New York, N. Y. 8-page circular No. 600 discusses automatic-transfer switches, remote-control switches, contactors and relays.

8 INDUSTRIAL ELECTRONICS—General Electric Co, Schenectady, N. Y. 44-page booklet No. GEA-4309 includes eight articles on fundamentals of industrial electronics.

9 FLUORESCENT LIGHTING — Hudson American Corp, 25 W 43rd St, New York 18, N. Y. 16-page catalog, entitled "Bestran Ballasts for Fluorescent Units," describes a new technique in ballast construction.

10 SAFETY SWITCHES—Square D Co, 6060 Rivard St, Detroit 11, Mich. 76-page catalog No. 129 contains photographs and listings of safety switches, service equipment, multibreakers and other circuit breakers, panelboards, bus and feeder ducts, motor controls and pressure switches.

11 ELECTRICAL INSULATION — Owens-Corning Fiberglas Corp, Toledo 1, Ohio. 24-page catalog No. EL44-7 describes properties, forms and applications of Fiberglas electrical insulation materials.

12 CERAMIC INSULATION — Electronic Mechanics, Inc, 70 Clifton Blvd, Clifton, N. J. 8-page bulletin No. 102 introduces Mykroy mica ceramic insulation in sheets for switchboard panels, large inductance bars, large meter panels, transformer covers, switch connecting rods, etc.

13 STORAGE BATTERY—B F Goodrich Co, Akron, Ohio. 4-page bulletin No. 61 gives information on rechargeable wet storage battery for flashlights. Bulletin recommends charging procedures and gives data on care of battery and its rechargers.

14 BANDING AND SPLICING—Punch-Lok Co, 321 N Justine St, Chicago 7, Ill. 6-page folder describes tools used in Punch-Lok method of banding and splicing electrical applications.

MAINTENANCE MATERIALS

15 PLASTIC COATING — Amercoat Div, American Pipe & Construction Co, P O Box 3428, Terminal Annex, Los Angeles 54, Calif. Folder, entitled "Amercoat No. 33 Plastic Coating," discusses properties, uses and benefits of this general-purpose cold-applied protective coating.

16 COLLOIDAL GRAPHITE—Acheson Colloids Corp, Port Huron, Mich. Folder No. 440 describes a number of new dispersions of Dag colloidal graphite in various fluids.

17 PACKINGS—Wayne Davies & Co, 326 Pleasant St, Worcester 2, Mass. 4-page form No. 21 and inserted sheet on double "U" packings give construction details, dimensions and suggestions for improving hydraulic packing service.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ OIL PURIFICATION—Honan-Crane Corp, 1200 6th St, Lebanon, Ind. First issue of publication, entitled "Clean Oil," gives reports on outstanding engineering and installation developments in oil-purification field, with engineering and scientific discussions of specific problems.

MECHANICAL TRANSMISSION

18 V-BELTS—B F Goodrich Co, Akron, Ohio. Conversion chart and price list for fractional hp V-belts gives sizes and conversion data on standard O, A and B section belts for refrigerators, stokers, oil burners, pumps, compressors, etc.

19 LEATHER BELTS — Graton & Knight Co, 356 Franklin St, Worcester 4, Mass. 56-manual discusses how to pick right leather belt for job, how to decide between Modern-Group drive and automatic-tension drive, how to compare efficiency and cost of multiple v-belt drives and flat-leather automatic-tension drives, etc.

20 V-BELT DRIVE — Multiple V-Belt Drive Assoc, 140 S Dearborn St, Chicago 3, Ill. 16-page booklet, entitled "19 Reasons Why It Is The Dominant Drive of Industry," presents basic advantages of a multiple V-belt drive.

(*Continued on page* 186)

HOW TO ORDER

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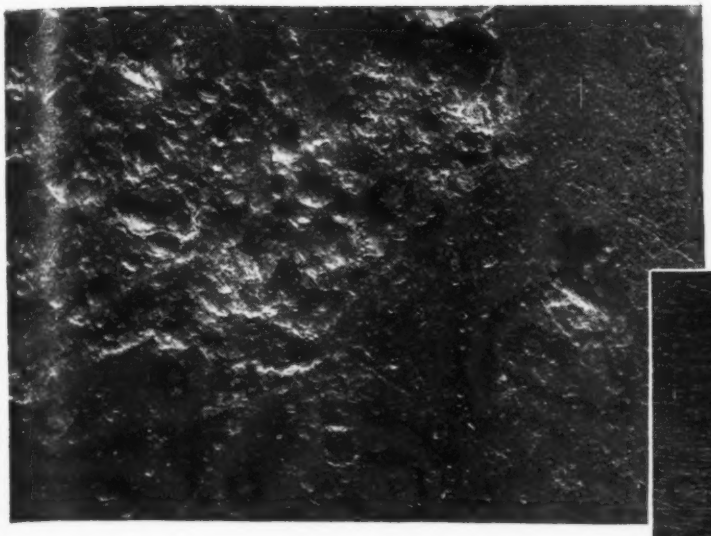

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APEXIOR keeps metal young by providing an effective and long-lasting barrier against water and corrosion. It retards scale formation, lengthening the periods between cleaning and making scale removal easier. Operating efficiency is thus improved and manpower conserved.

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APEXIOR NUMBER 1 is a water and steam resistant paint, purposely developed to provide a protective coating for steel and iron. It is not affected by high temperatures, high pressures or ratings, by chemical treatment of boiler water or by varying feedwater conditions. It does not retard heat transfer.

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Laminated Shim Company, Incorporated

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LAMINUM

THE SOLID SHIM THAT peels FOR ADJUSTMENT

New Bulletins

(*Continued from page* 184)

METALS AND ALLOYS

21 **ALLOY STEELS**—American Steel Castings Co, Ave L and Herbert St, Newark 1, N. J. 4-page bulletin indicates some of the more popular corrosion and heat-resisting alloy steels produced by company.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **COPPER-BASE ALLOYS** — Bridgeport Brass Co., Bridgeport 2, Conn. Revised manual includes technical data and other information on Duronze alloys in form of sheet, strip, rod, wire and tubing for applications where resistance to severe corrosion, great strength, toughness, wearability and ease of manufacture are required.

22 **METAL CORROSION**—International Nickel Co, 67 Wall St, New York 5, N. Y. 54-page publication, entitled "Corrosion," gives a comprehensive analysis of corrosion principles for both the practical man and technician in the metal field.

PIPING, FITTINGS VALVES AND SPECIALTIES

23 **POWER-PLANT EQUIPMENT** — Williams Gauge Co, 2055 Pennsylvania Ave, Pittsburgh 12, Pa. 24-page catalog No. 449 describes flanged silent check valves, steam pump governors, steam-operated traps, high- and low-alarm water columns, water gages, ball gage cocks, safety feedwater regulators, standard regulators and pump valves.

24 **HOSE AND FITTINGS** — Bowser, Inc, Fort Wayne, Ind. 4-page booklet contains descriptions and photographs of Bowser hose and fitting line.

25 **AUTOMATIC VALVES**—A W Cash Valve Mfg Co, Decatur, Ill. 28-page catalog features complete line of Cash-Acme automatic valves and pressure controls for use with water, air, steam and oil.

OTHER EQUIPMENT

26 **COOLING TOWERS**—Binks Mfg Co, 3114-40 Carroll Ave, Chicago 12, Ill. 4-page bulletin No. 700 introduces a new departure in small cooling tower design, in which air propulsion unit consists of a slow-speed double-inlet blower, resulting in exceptionally quiet operation. 8-page bulletin No. 600 features a complete line of horizontal induced-draft cooling towers, in which air inlet supply is obtained through rear, using aluminum alloy propellor-type induced-draft fans.

27 **COLD-WATER DEAERATORS** — Cochrane Corp, 17th & Allegheny Ave, Philadelphia 32, Pa. 4-page reprint No. 36 describes application and general design of cold-water deaerators to prevent corrosion of pipelines, heat-exchange equipment, etc.

28 **GAS- AND AIR-HANDLING EQUIPMENT** — Roots-Connersville Blower Corp, Connersville, Ind. 4-page bulletin No. G-81-D covers rotary positive blowers and gas pumps, centrifugal blowers and exhausters, rotary positive vacuum and liquid pumps, rotary displacement gas and liquid meters, and inert-gas generators.

29 **AIR COMPRESSORS** — Ingersoll-Rand Co, Phillipsburg, N. J. 24-page catalog No. 1011, entitled "A Little Air Power Will Do Many a Big Job," shows what is being done with small compressors or with a small air amount from a shop air line.

OFFICIAL U. S. NAVY PHOTO

*WHEN PURIFIERS ARE DE LAVALS

ON land or sea, De Laval Oil Purifiers provide maximum protection against *both* principal sources of lubrication failure—*water* and *dirt*. They utilize centrifugal force to instantaneously remove these *two* trouble-makers from the oil and thus constantly maintain its lubricating efficiency. By keeping the oil continuously and unfailingly clean and dry, they enable it to perform with "new oil" efficiency and safety over exceptionally long periods of time.

Whether the power unit is a Diesel engine requiring only a De Laval centrifugal Oil Purifier, or a turbine where use of the De Laval-Funk Process—the ultimate in turbine oil protection—is indicated, there is no more practical, efficient means of guarding it against lubricating oil trouble than by means of a De Laval centrifugal Oil Purifier operating on continuous by-pass. This will insure that the oil is freed of impurities and water three or four times daily.

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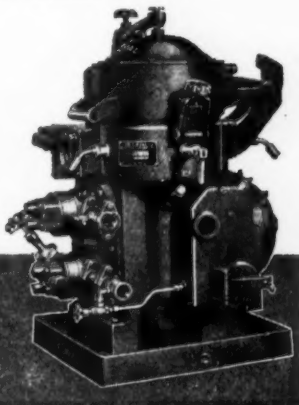

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Recessed Brass Seat

Save Time, Space and Cost on Any Job

90 Union Elbows are but one of many types of Jefferson Convenience Unions which help assure economy and eliminate unnecessary pipe joints. They help solve difficult piping problems.

All Jefferson Unions—Standard or Special—are available with the exclusive Jefferson Recessed Brass Seat. This feature provides a seat which is practically one piece with the iron and which is not exposed to contact with pipe ends and therefore cannot be dislodged when pipe is screwed too far into the body of the union.

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Record-breaking Marauders are built with the Aid of

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Hailed as the outstanding 2-engine bombers of the European air war, the Marauders hold the record for the lowest combat losses in that theatre—only one-third of one per cent! As many as 100 combat missions have been made by a single Marauder without injury to any of her crews.

B-26 Marauders are built by the Glenn L. Martin Co., whose great plant outside of Baltimore uses over 40 Frick Refrigerating Machines for air conditioning and other special cooling services.

Remember: For the really important jobs, specify Frick Refrigeration and Air Conditioning.

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AIR CONDITIONING

30 **INTERVAL TIMER**—Paragon Electric Co, 37 W Van Buren St, Chicago 5, Ill. 4-page bulletin No. 4492 gives engineering features and list prices of Model 2500 manually preset interval timer.

31 **HEAT EXCHANGERS** — Whitlock Mfg Co, Hartford 1, Conn. 12-page booklet, entitled "Care and Handling of Heat Exchangers," gives hints on efficient use of heat-transfer equipment.

32 **PNEUMATIC SAW** — Cleveland Pneumatic Tool Co, 3781 E 77th St, Cleveland 5, Ohio. 1-page bulletin No. 95S covers the Cleco pneumatic baby saw.

33 **BRICK FLOORS**—Belden Brick Co, Canton, Ohio. 16-page brochure describes a new permanent acidproof brick floor, which is claimed not to crease, groove, chip, dust off or require patching.

34 **MATERIALS-HANDLING EQUIPMENT**—Lewis-Shepard Co, 300 Walnut St, Watertown 72, Mass. 76-page general catalog No. 22 shows third-dimension pictures of materials-handling equipment in operation.

35 **MULTISTAGE PUMP**—Pump Div, Byron Jackson Co, P O Box 2017, Terminal Annex, Los Angeles 54, Calif. 16-page bulletin No. 44-4620 describes a vertical multistage pump for handling liquids where the net positive suction head is limited.

36 **MACHINE CUTTING TIPS**—Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 12-page bulletin discusses Airco "45" and "45M" high-speed machine cutting tips for faster cutting.

37 **CARBIDE TIPPING** — Handy & Harman, 82 Fulton St, New York 7, N. Y. 4-page bulletin No. 11-A covers subject of brazing carbide tool tips with Easy-Flo No. 3.

38 **RUBBER DEVELOPMENT** — B F Goodrich Co, Akron, Ohio. 28-page booklet, entitled "Typical Examples of B F Goodrich Development in Rubber," contains reproductions of 26 advertisements. They cover a wide variety of product applications and show how rubber has solved many perplexing problems.

39 **VARI-TYPER** — Ralph C Coxhead Corp, 333 6th Ave, New York 14, N. Y. 12-page booklet describes a varityper engineering model for mechanical lettering in drafting operations.

40 **INDUSTRIAL SPRINGS**—Railway Steel-Spring Div, American Locomotive Co, 30 Church St, New York 7, N. Y. 12-page bulletin No. 5001 gives a quick digest of most popular types of Alco springs.

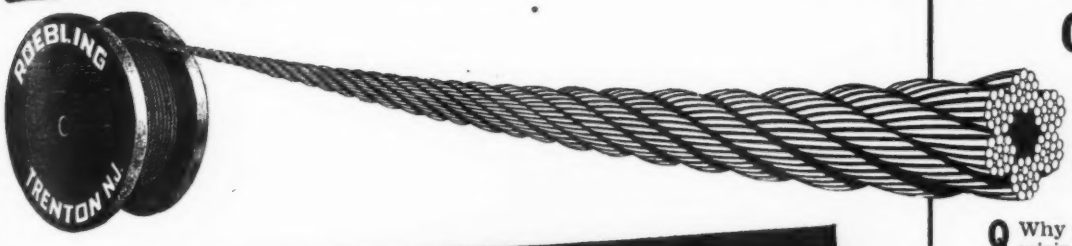
Two-Million-Volt Mobile X-Ray Unit

X-ray pictures can be taken through pieces of steel a foot thick with a new two-million-volt mobile X-ray unit developed in the research laboratory of the General Electric Co. Dr Ernest E Charlton, the scientist in charge of the work, made the first announcement of the high-voltage device at recent National Electronics Conference in Chicago.

This doubles the voltage of X rays available to industry for examination of metal sections to find defects. Up to now the most powerful X-ray unit in general use has been the one-million-volt apparatus developed in the GE laboratory. More than 50 are now actively serving the war effort in the U. S. and abroad.

Collaborating in development of the million- and two-million-volt machines was Willem F Westendorp, whose name appears as joint author of the paper Dr Charlton presented.

ROEBLING



TO KEEP SERVICE UP—COSTS DOWN

QUESTIONS AND ANSWERS

Q Why are three or more seizings recommended to hold the end of a rope when one would keep it from unraveling?

A **With non - preformed rope it is almost impossible to hold the strands sufficiently tight with one seizing. If rope lay is lost or if any of the strands is allowed to shift from its balanced relation with respect to the others, improper rope life will very likely result.**

Q Is it necessary to use seizings on a preformed rope?

A **It is not necessary to use seizings to keep preformed rope from unlaying because all wires and strands are set to their helical forms. However, it is advisable to use seizings to prevent the strands from being forcibly unlaid and distorted when cutting or handling the rope. Naturally, preformed rope must be seized when preparing it for socketing.**

YOU CAN'T TAKE WIRE ROPE FOR GRANTED!

Your building's profits go "up and down" with your elevators! That's why you can't take wire rope for granted ... why you can't depend on "just as good" wire rope.

And that's why you need *tough* Roebling *"Traction Steel"* Elevator Rope! Its proven stamina to deliver long service ... its engineering—both in our plant and available on your job—assures economical operation and maintenance by reducing costly shutdowns.

But find out for yourself how Roebling "Traction Steel" Elevator Rope fights fatigue and wear; how its extra strength and flexibility make it tops for elevator service.

And find out, too, how Roebling engineers can help you put rope to work—right! A telephone call to our nearest branch office is the first step towards maximum service and safety and savings from your elevator equipment. Why not make it today?

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

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ELECTRICAL WIRES AND CABLES • COLD ROLLED STRIP
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PACEMAKER IN WIRE PRODUCTS

A Pictograph
OF EFFICIENT DUST DISTRIBUTION

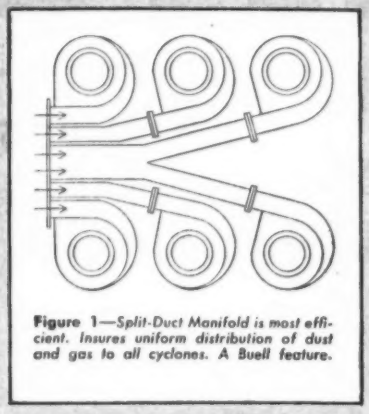


Figure 1—*Split-Duct Manifold is most efficient. Insures uniform distribution of dust and gas to all cyclones. A Buell feature.*

THE MOST EFFICIENT METHOD
(Buell's)

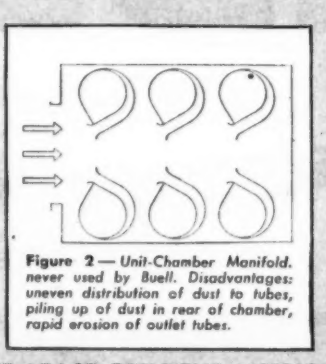
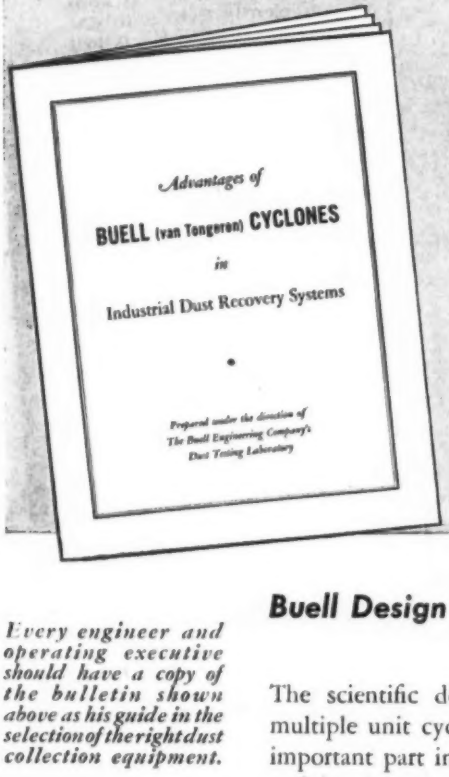


Figure 2 — *Unit-Chamber Manifold. never used by Buell. Disadvantages: uneven distribution of dust to tubes, piling up of dust in rear of chamber, rapid erosion of outlet tubes.*

THE LEAST EFFICIENT METHOD
(Never used by Buell)



BOTTOM VIEW OF MANIFOLD ASSEMBLY

Every engineer and operating executive should have a copy of the bulletin shown above as his guide in the selection of the right dust collection equipment.

Buell Design **ELIMINATES CLOGGING MINIMIZES EROSION**

The scientific development of inlet manifolding for multiple unit cyclone dust collectors has played an all important part in the uniform distribution of both gas and dust in cyclone collectors. How proper manifolding is achieved in Buell Dust Recovery Systems is shown in the pictograph on this page. What happens when the dust load is not uniformly distributed, and how serious these disadvantages may be, is best described in the bulletin shown on this page, from which these two manifold sketches were taken.

buell
DUST RECOVERY SYSTEMS

BUELL ENGINEERING COMPANY, INC.
10 Cedar Street, New York 5, N.Y.
Sales Representatives in Principal Cities

DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

Electric-Power Coal Needs After V-E Day

For the twelve months following V-E Day coal requirements for the electric power industry were set at 72,900,000 tons of bituminous and anthracite, of which 2,500,000 tons would be considered contingent upon a poor water year with its resultant slump in hydroelectric output.

In placing its requirements before Solid Fuels Administration for War, Office of War Utilities asked for 67,000,000 tons of bituminous coal, plus 2,500,000 additional if a dry year is encountered, plus 3,400,000 tons of anthracite. The over-all request was about 10,000,000 tons below that sought for coal year ending next April 1 needs for which were set at slightly more than 82,000,000 tons, including a 3,500,000-ton allowance for a low-water year. During the first two quarters of this coal year, electric utilities burned 3,500,000 tons less than they could have under this budget, and further savings between now and April are considered possible in view of current hydro conditions. Part of the coal savings was due to exceptions granted utilities for fuel oil use under Petroleum Distribution Order 13. No fuel oil has been anticipated in the request for 82,000,000 tons of coal.

Estimate for the twelve months following V-E Day assumes that no oil will be used for generation, but it was pointed out that considerable oil will be used if there is any appreciable decrease in prices. Between 1,000,000 and 2,000,000 tons of the reduced estimate for the year following V-E Day is based on higher efficiency of new power plants coming into service.

Reports from Bureau of Mines

Forcing gas and air into underground oil reservoirs has brought 30% increase in production in recent years from some of the oil wells in Illinois *stripper* fields, according to a survey report released by Dr R R Sayers, Director of Bureau of Mines. A stripper field is one where most of oil obtainable by primary methods has been extracted and where continued production becomes more economically impracticable. Report contains information on 99 Illinois operations, with details on how gas and air is injected into wells to provide artificial force to drive oil from subsurface sands to wells. Copy of Report of Investigations 3783, *Air- and Gas-Injection Operations in Oil Fields of Illinois*, may be obtained by writing Bureau of Mines, Dept. of Interior, Washington 25, D. C.

Tests just completed on coals from four districts in Alaska reveal that all can be used to produce gasoline and other liquid fuels. Alaska coals will be studied in greater detail as Bureau advances in its 5-year synthetic liquid fuels research program. Carbonization assays already completed on 14 coal samples prove that coke or char into which they can be converted could be employed in one synthetic liquid fuels process to manufacture gasoline, diesel fuel, lubricating and fuel oils and paraffin wax. In addition, tar and oil that

ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGIN

BURGESS SNUBBER BULLETIN for Diesel Exhaust Noise Control

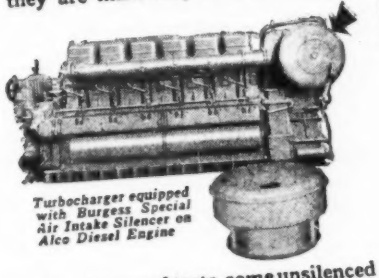
EFFECT OF SPECIAL INTAKE SILENCER ON SUPERCHARGED DIESEL ENGINES

It is the opinion of many in the Diesel field that, by the end of the present war, all new 4-cycle Diesel engines will be equipped with mechanically-driven or with exhaust gas driven superchargers (turbochargers). At the present time, most Diesel engine manufacturers supply their engines to suit the customer's specifications . . . either supercharged or non-supercharged.

It is possible to install turbochargers on 4-cycle engines without radical changes in engine design or construction. These usually consist of alterations to gears and camshaft.

The purpose of the supercharger is to increase the mean effective pressure. This is accomplished by compressing more air into the cylinders. The intake valves are timed to open sooner, and the incoming air rushes in under pressure. The cold air stream absorbs heat from the top of the cylinders and pistons, and provides for the burning of more fuel without overheating.

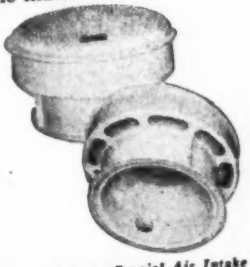
While turbochargers will increase the power rating of the Diesel engine, they are inherently and necessarily noisy In sound tests, some unsilenced turbochargers have reached a noise level of 130 decibels, which corresponds to the sound of a wartime air raid siren at close range



Turbocharger equipped with Burgess Special Air Intake Silencer on Alco Diesel Engine

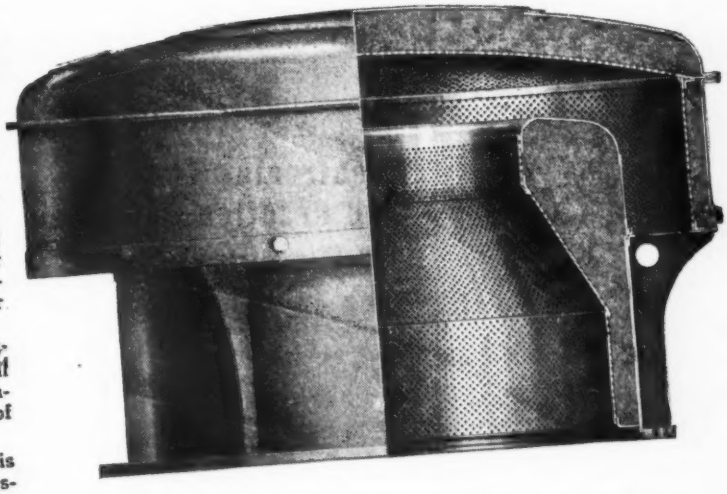
To suppress the noise of Diesel superchargers, Burgess-Manning has developed the Burgess Special Air Intake Silencer (indicated by the arrow on the Alco Diesel Engine). It completely subdues the air intake whine of the supercharger. In the words of one Diesel engine manufacturer . . . "The noise level of our turbocharged engines has been reduced so that the difference between a supercharged and a non-supercharged engine is not noticeable, except when standing immediately adjacent to the turbocharger."

The inner sections of the Burgess Special Air Intake Silencer are packed with acoustic material and covered with perforated metal. The venturi type entrance reduces restriction to air flow and it increases sound absorption within the silencer by exposing the sound that leaves the turbocharger to the maximum area of acoustic material.



Close-up of Burgess Special Air Intake Silencer showing venturi type entrance and perforated metal inner liner.

Since superchargers are so desirable for improving engine performance, it is fortunate that the air intake noises can now be subdued to the vanishing point. A Burgess-Manning Special Air Intake Silencer is an essential accessory to every well-engineered supercharged Diesel installation, and all Diesel engine designers and operators should be thoroughly acquainted with the construction and action of this important noise-suppressing unit.



DO YOU HAVE BACK PRESSURE PROBLEMS?

Back pressure problems are characterized by poor engine efficiency, excessive intake or exhaust noise, overheating, and similar ills that beset Diesel engine operation. They may be caused by intake or exhaust pipe of improper length, faulty methods of silencing, or by improper installation of silencing equipment in the air intake or exhaust line.

Manometer readings measure back pressures . . . determine the pulsating flow in exhaust and intake systems. However, a simple manometer cannot tell the whole story.

The Burgess sampling manometer differs from the simple manometer, because it measures the pressure at intervals of a few degrees throughout the complete engine cycle. By plotting the pressures throughout the complete cycle, a true analysis of pressure conditions can be made.

The Burgess manometer test is helpful when the Diesel operator suspects insufficient air flow is "starving" the engine or compressor. The opposite is also true with overheated Diesels which may be caused by an abnormal supercharging condition.

If there is any doubt regarding harmful back pressure effects on your Diesel engine, it may be helpful to consult a Burgess-Manning engineer. He will gladly co-operate in the study of your back pressure problems.

Published by BURGESS-MANNING COMPANY Chicago, Illinois

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ESS—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGI

COMPLETE SATISFACTION IN EXHAUST AND INTAKE QUIETING—SPECIFY BURGESS SNUBBERS—FOR C

WANTED—additional Products to Sell—

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Nationally recognized corporation representing manufacturers of highest grade machinery and equipment for steel mills, industrial plants, municipal water and sewage works, steam power plants, etc., for many years, will handle additional products.

Present sales engineering staff is composed principally of graduate engineers. Proper facilities and personnel, including engineers, draftsmen and field superintendents, are available to design, erect and place in service complete installations of equipment handled.

* Offices located in New York, Philadelphia, Pittsburgh, Cleveland and Chicago. Certain products also handled on a national basis through a large number of distributors.

Write to

Box 784 POWER
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these coals can produce could be harnessed by another method to make gasoline, diesel fuel and fuel oil. Report by W A Selvig, W H Ode and Joseph D Davis, chemists at Bureau's Central Experiment Station, Pittsburgh, Pa, shows that tar and light-oil yields from Alaskan coals vary widely. Technical Paper 668, *Low Temperature Carbonization of Alaskan Coals*, may be obtained from Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 10¢.

Electronics Theory and Practice Course

Plans for a professional course in electronics, emphasizing applications to television and highly developed production methods were announced recently. Primary purpose of this new course of study will be to combine instruction in advanced theory at Massachusetts Institute of Technology with work in design and production of electronic equipment at Philco Corp.

Under the new cooperative course, leading to the master of science degree, a selected group of students in electrical engineering department will spend alternate terms at the Institute and at Philco plants. Institute's program of cooperative industrial engineering courses differs from other cooperative plans in that its purpose is a carefully supervised integration of professional education in engineering theory with specific industrial practice. During terms when students are assigned to cooperating industrial plants, they continue out of hours part of regular academic work required in their Institute course and also have special instruction dealing with their industrial activities. Plant experience is thus thoroughly integrated with professional theoretical instruction. Students upon graduation are familiar with fundamentals of industrial methods and policies and are aware of what is expected of them as practicing engineers.

American Development of Jet Propulsion Engine

New jet engine, under development at Westinghouse for Bureau of Aeronautics, Navy Dept, is expected to produce more pounds of thrust for a given fuel amount and pounds of weight than any engines brought from Europe for study.

An enormous amount of ground has been covered in the study and experimentation of gas turbines, of which jet-propulsion engines are but one form. Essentially, work of three sorts is being done. First is in high-temperature metallurgy field, because success of combustion-gas-turbine cycle depends on temperatures in turbine itself being 1200 F or more, which is well beyond highest steam-turbine temperatures. The higher the allowable temperatures, the greater will the efficiency be and the wider the field of usefulness of gas-turbine cycle as a prime mover.

Second and most active phase of activity is design, building and testing of different units with many variations as to size and arrangement. This includes designs for

YOUR ANSWER for speeding wartime MAINTENANCE

Easier Way to Clean Diesel Filtering Units

Peak Diesel operating efficiency is largely dependent on REGULAR cleaning of lube oil, fuel oil and air filtering units. For, only when this equipment is completely free from sludge and other deposits and is functioning at full filtering capacity, can maximum power output and fuel economy be secured.

DETAILS FREE!

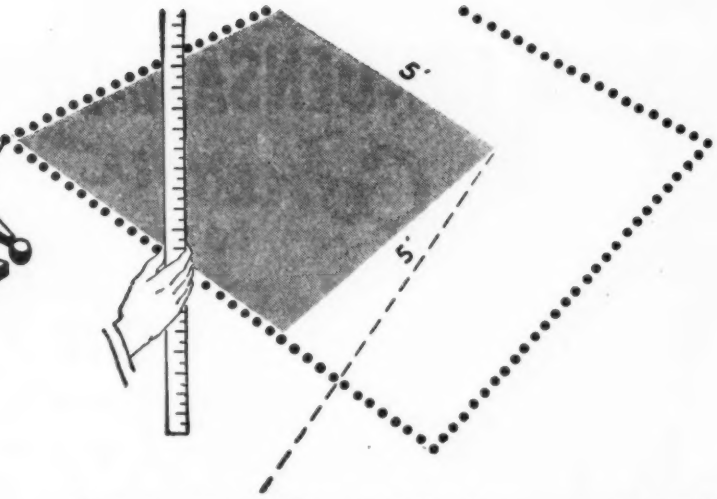
One easy, fast way to clean filtering units is the unusually effective, low-cost Oakite method . . . using Oakite materials and techniques PARTICULARLY designed for this purpose. You will find full information in a new Oakite Service Report. This factual report is FREE on request, —write for your copy TODAY.

OAKITE PRODUCTS, INC.
33 Thames St., New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* CLEANING

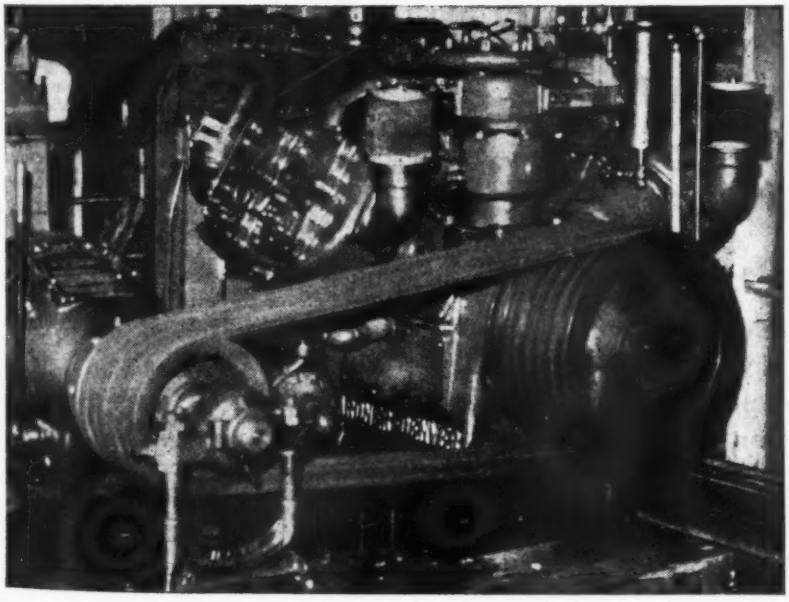
Buy Bonds for Victory

SPACE SAVER!



Five square feet! That's all the floor space needed for the Gardner-Denver "WB" Water-Cooled Vertical Compressor. Yet, despite this unusual compactness, there has been no sacrifice in efficiency. The "WB" will operate at efficiencies comparable to those of large two-stage horizontal compressors.

A distinctive design with two small- rather than one large-diameter, low-pressure cylinder, in conjunction with each high-pressure cylinder, permits the use of small, lightweight pistons in all cylinders. This construction considerably decreases the inertia load and makes possible a reduction in compressor dimensions without sacrificing capacity.



For complete information, write for descriptive bulletin on "WB" compressors. Gardner-Denver Company, Quincy, Ill.

OTHER "WB" FEATURES

1. Completely water-cooled cylinders and combination radiator and air-cooled intercooler assure a cool-running compressor . . . save lubricating oil and assure lower discharge temperatures.
2. Drop forged crankshafts mounted on Timken roller main bearings for smooth operation.
3. Efficiency not affected by altitude or temperature change.
4. Available with built-in motor or can be furnished for V-belt or direct drive.
5. Efficient "clean-air" after-cooler removes moisture from air and further reduces air temperatures for longer life on hoses and tools. Available as additional equipment.

PAVING BREAKERS

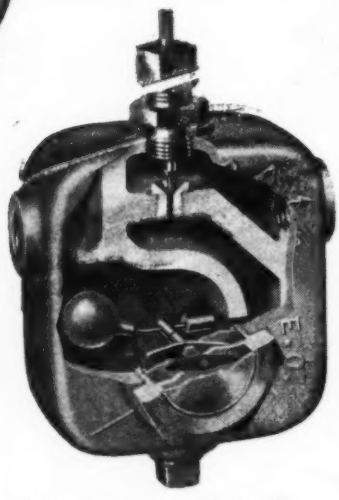
Gardner-Denver Paving Breakers deliver a fast, powerful blow that helps speed industrial demolition work.

GARDNER-DENVER *Since 1859*

for MEDIUM CONDENSATE LOADS

Convert to the M-41-S COE DRAINATOR

for
LAUNDRY PRESSES
UNIT HEATERS
PIPE COILS
SATURATED STEAM LINES
PLATEN PRESSES
CORRUGATING MACHINES
STERILIZERS
KITCHEN EQUIPMENT, ETC.



Model 41-S-Drainator, with capacity to handle a majority of the condensate loads usually put on 1/2" steam traps, affords the many features of this exceptional steam trap in a smaller, lower priced unit.

Simple installation that saves fittings, visual indication of operation, consistent operation at highest efficiency, quick start-ups of cold equipment and unequalled freedom from maintenance and repair costs, are features.

In rebuilding for highest efficiency, don't overlook this new and strictly modern steam trap.

The COE MANUFACTURING Co.
501 BANK STREET, • PAINESVILLE, OHIO

DRAINATOR • THE ADVANCED STEAM TRAP

Write for a copy of Bulletin No. 903-B or ask us to send an engineer to discuss your condensate handling problems.

three main components of a gas-turbine cycle (axial-flow compressor, combustor and gas turbine) and relatively few but important controls and auxiliaries.

Third is investigation of possible uses. This involves extensive thermodynamic and heat-balance calculations for a wide variety of simple open-cycle systems, heat-recovery open-cycle systems and closed-cycle systems—all predicated on assumed efficiencies, loadings and costs.

MPC Meeting Next April

Midwest Power Conference will hold its eighth annual meeting at the Palmer House, Chicago, on April 9 and 10. A session on the gas turbine will be in the program for the first time. Other sessions planned deal with industrial power plants, feedwater treatment, recent developments in heating and air conditioning, fuels and combustion, central station practice, postwar load planning, diesel power and hydropower. Three electrical sessions, the all engineers' dinner and joint luncheons with American Society of Mechanical Engineers and American Institute of Electrical Engineers complete preliminary program.

Following agencies are cooperating with Illinois Institute of Technology in sponsoring the conference: Iowa State College, Michigan State College, Northwestern University, Purdue University, State University of Iowa, Universities of Illinois, Michigan, Minnesota and Wisconsin, local sections of the Founder and other engineering societies, and Engineers' Society of Milwaukee.

Engineers Tackle Diesel-Engine Vibration Problem

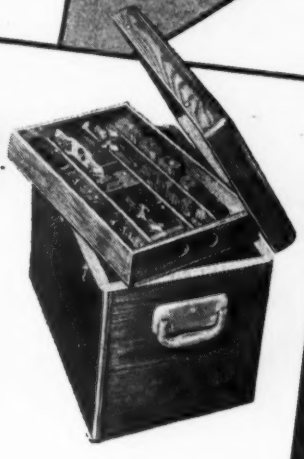
Society of Automotive Engineers' 1945 annual meeting in Book-Cadillac Hotel, Detroit, on Jan. 12, in an engineering discussion of causes and cures of torsional vibration in diesel engines, outlined basic and essential engineering services by SAE to armed forces.

Torsional vibration, more acute in diesel engines than in gasoline, and aggravated by extensive use of diesels for heavy-duty service in global war, hampers operations by causing periods of engine roughness resulting in rapid wear of parts and other service difficulties. Generally, vibrations were ascribed to diesel's high-compression pressures and comparatively high and prolonged explosion pressures, which set up torsional strains in crankshaft and reciprocating parts.

Frederic P Porter of Fairbanks, Morse & Co, Beloit, Wis., described methods of ascertaining and calculating torsional vibrations as following a long and tortuous mathematical trail involving literally hundreds of computations necessary to evaluation of an equivalent mass-elastic system, which will have about same torsional vibration characteristics as the actual system. The detailed work requires numerical evaluation of inertia and stiffness factors for all moving parts of the system, plus calculations for natural frequencies, peak amplitudes or stresses and forced vibration

AS PRODUCTION MANAGER, I'M 100% IN FAVOR OF...

DEXTER VALVE RESEATING MACHINES AND CUTTERS



Here's Why

It's bad enough to lose one production man-hour these critical days — but when one of our main valves leaked badly and had to be repaired or replaced, a whole department used to quit work for hours, sometimes days.

That was before we had Dexter Valve Reseating Equipment, however. Now, one man can *reseat* a valve in a few minutes *right on the line*, and those big production time losses are a thing of the past. Our production chart shows big gains.

No more big losses in steam, air, water and oil — and resultant power losses, either. And the reseated valves are actually *better* than new, according to our engineers.

★ ★ ★

A large part of our production facilities is devoted to war work. Orders for Dexter Machines and Cutters, from firms who want this economy and efficiency, have far exceeded our non-military manufacturing facilities. Please be patient — we will deliver just as quickly as possible.

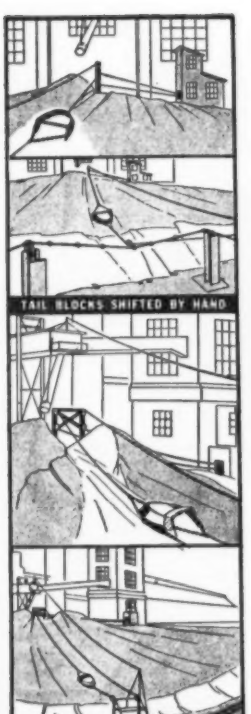
FOR GLOBE, GATE AND PUMP VALVES

What's your Valve leak problem?

Write in—today—about your valve leaks, giving make, size, type and material . . . water, steam, or air, and the pressure. We'll tell you what we can do to solve it, without obligation.

21

THE LEAVITT MACHINE COMPANY
ORANGE, MASSACHUSETTS



Sketch shows two types of Sauerman Scraper Systems with different methods for shifting the tail blocks.

Store More Coal Now
at Lowest Cost with a
ONE-MAN SAUERMAN SCRAPER

Two small Sauerman Scrapers handle adjoining stockpiles of coal and coke for mill furnaces.

At hundreds of power plants, Sauerman Power Scrapers are storing and reclaiming coal in quantities ranging from a thousand tons a month to over a million tons a year at costs of only a few cents per ton handled.

A Sauerman System is simple and easy to operate. From a station overlooking the storage area a single operator controls every move of the scraper through a set of automatic controls.

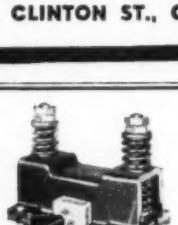
A Sauerman System makes the best use of whatever space is available by building a safe, high pile in compact layers. There is no segregation of lumps and fines—no air pockets to promote spontaneous combustion. Every Sauerman installation is a permanent, trouble-free investment — maintained at small expense—lasting as long as the plant it serves.

Write for Catalog

SAUERMAN BROS., Inc.
562 S. CLINTON ST., CHICAGO 7, ILL.

DO YOU LOSE TIME— POWER— and MONEY

because of arched and clogged coal bins, hoppers and chutes?



SYNTRON

"Pulsating Magnet"

ELECTRIC VIBRATORS

with Adjustable Power Assure

FREE FLOWING COAL
Bins, Hoppers and Chutes

Eliminate costly coal stoppages, by preventing "arching-over" and "hanging-up".

Available in eight sizes—from a little 4 lb. model up to a big 500 lb. model.

Write for illustrated folder

SYNTRON CO.
492 Lexington Ave. Homer City, Pa.

amplitudes or stresses—all based upon sketchy literature.

T H Peirce of H A King Co, Detroit, advocated application to diesel engines of bonded-rubber torsional-vibration dampers which work in combination with crankshafts to dampen vibration periods. He cited cases of multicylinder diesels in which application of dampers resulted in making engine operate smoothly throughout a wide speed range.

Afternoon diesel-engine session reviewed piston-cooling procedures and methods of solving piston lacquering problem. E T Vincent, of University of Michigan, Ann Arbor, Mich., asserted that published knowledge on piston temperature and heat flow leaves so much to be desired that employment of newly developed piston-temperature-measuring techniques has become necessary in determining even the fundamentals of heat-flow problem.

H C Mougey, of research laboratories div, General Motors Corp, Detroit, reported that piston lacquering, like sludge formation, resulted from various causes. Principal cause of low-temperature sludge is said to be water, with varnish no serious problem. At intermediate temperatures, sludge formation may be caused either by oil or fuel, and varnish may be serious. At high temperatures, oil causes sludge and varnish again may be serious. Under commercial conditions, all three classifications tend to overlap and maintenance, operating conditions and engine design become important.

ASRE Research Program

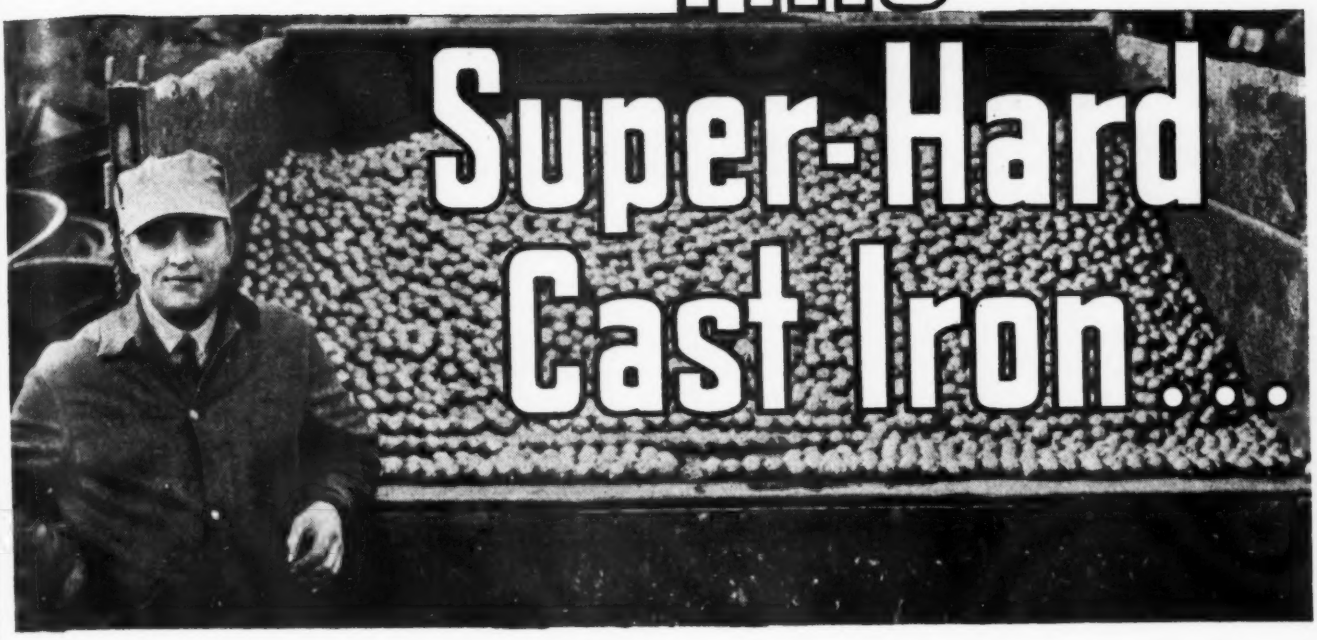
Research program sponsored by the American Society of Refrigerating Engineers was launched recently when four well-known institutions engaged in refrigeration education and research each received a grant of $500 from the Society. Grants were given to the Massachusetts Institute of Technology, Case School of Applied Science, Oregon State College and University of Texas, on recommendations by ASRE Committee on Education and Research, headed by George I Boone. University of Illinois and University of Tennessee will receive similar amounts as soon as final project details are completed.

New Lubrication Society

Lubrication engineers have organized a nonprofit body known as American Society of Lubrication Engineers, with headquarters at 135 S LaSalle St, Chicago. Objective is to put on a sound basis fundamental precepts of lubrication. Society intends to promote subject of lubrication in various educational institutions to better prepare future members of industry for a more complete understanding of operational problems to follow.

Membership consists of representatives of educational field, machinery builders, lubricant suppliers and consumers as represented by various phases of industry. Officers of ASLE are: *President*: C E Pritchard, Republic Steel Co; *Vice-President*: J C Peebles, Dean of Engineering, Illinois Institute of Technology; *Secretary and treasurer*: B H Jennings, Prof of Mechanical Engineering, Northwestern University. Di-

This Super-Hard Cast Iron...



NI-HARD Helps Save $10,000 Annually for one Company

The Pennsylvania Power & Light Company is the world's largest single consumer of anthracite.

It utilizes fine-sized raw coal from nearby culm banks . . . fuel too small for stokers but adaptable for pulverized firing.

Searching for ways to cut pulverizing costs, the power company instituted a test of Ni-Hard, a nickel-chromium alloyed white iron. A full-scale production test for a period of at least one year was decided upon.

Grinding-balls of Ni-Hard were tested against the customary heat-treated forged-steel product. The test was made with coal of high ash content (14 to 16%), by nature more difficult to pulverize than bituminous types.

The superiority of Ni-Hard may be gathered from the results tabulated below.

For this application, as for many others, Ni-Hard renders substantial savings in money, despite higher initial cost.

It is probably the hardest and toughest cast iron available. Sand cast, its BHN ranges from 500 to 625 . . . chill cast, it rises to 725.

Its resistance to wear . . . with corresponding decrease in interruptions for replacement or repair . . . lowers maintenance expense and operations cost.

Any design of casting may be produced with this inexpensive nickel-chromium alloy. Ni-Hard ash pans, roll heads, mill liners, ash pipe and similar parts of power plant equipment have given record-breaking performance.

We invite consultation on the use of Ni-Hard or other alloys containing Nickel in your equipment. Send us details of your problems, for our recommendations.

Comparative Wear Loss of Grinding Balls

Kind of ball	Steel	Ni-Hard
Length of test	1-6-35 to 6-2-41	6-5-41 to 6-30-42
Coal pulverized, net tons	627,465	106,785
Ball consumption, lb.	419,603	33,114
Constant for ball wear, lb. per net ton	**0.67**	**0.31**

NI-HARD*

* Ni-Hard—Reg. U. S. Pat. Off. by The International Nickel Company, Inc., Canadian Pat. No. 281,986.

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall Street, New York 5, N. Y.*

For V-DAY BUILDING

BENEFIT BY CONNERY V-STIFFENED NON-BUCKLING LEAKPROOF BREECHINGS . . . .

We take pardonable pride in the fact that 100% of Connery output is going to war production projects. And we feel certain that the many plants using (and planning to use) Connery's Improved Expansion Stiffened Construction for stacks, breechings, ducts, etc., won't mind if we give our best to "our first customer," Uncle Sam.

As government priority construction slackens, however, we will be in a position to offer old and new customers specific help on their problems of power plant construction.

STACKS
•
BREECHINGS
•
UPTAKES
•
HOPPERS
•
AIR DUCTS

RECENT INSTALLATIONS

NEW HAMPSHIRE GAS & ELECTRIC CO.	PORTSMOUTH, N. H.
UNITED ILLUMINATING CO.	BRIDGEPORT, CONN.
ROCHESTER GAS AND ELECTRIC CO.	ROCHESTER, N. Y.
INDIANAPOLIS POWER & LIGHT CO.	INDIANAPOLIS, IND.
CONSOLIDATED GAS ELEC. LIGHT & PR. CO.	BALTIMORE, MD.
VIRGINIA PUBLIC SERVICE CO.	ALEXANDRIA, VA.
U. S. NAVAL TRAINING STATION	GREAT LAKES, ILL.
HENRY DISSTON SONS	PHILADELPHIA, PA.
QUARTERMASTER DEPOT	PHILADELPHIA, PA.

CONNERY CONSTRUCTION CO.
Second and Luzerne Sts. Philadelphia, Pa.

CONNERY
EXPANSION STIFFENED
CONSTRUCTION

rectors include D N Evans, Inland Steel Co; I L Harper, Lehigh Valley Railroad; and D E Whitehead, Carnegie-Illinois Steel.

First national convention will be held in Stevens Hotel, Chicago, Feb 8 and 9. Program will include presentation of technical papers by leading authorities on subjects pertinent to lubrication profession.

Classes in Diesel Locomotive Design

Latest technological advances in diesel locomotive design and maintenance were outlined graphically for two groups of railroad and other users of diesel equipment who attended special diesel instruction classes sponsored recently by Baldwin-Westinghouse at Pittsburgh and Philadelphia. The first meeting, at East Pittsburgh, under general supervision of J A Schoch, manager of Westinghouse heavy traction section, was conducted by W H Smith.

Purpose of classes was to acquaint Baldwin-Westinghouse diesel users with the capabilities and maintenance ease of their equipment to obtain maximum results with minimum maintenance work. From practical suggestions offered by those attending the classes, Baldwin-Westinghouse experts gathered material which may have a part in the design of 1945 models.

Jet Plane Secrets

GE engineers can now disclose some of the advantages of the jet-propelled planes, which the company is equipping with gas turbine engines, among them the fact that the propellerless craft can take-off almost from scratch without the warm-up required by conventional ships.

"Full thrust from the gas turbines is available in about 30 sec after they are started, thereby eliminating any delay for warming up the engines," according to GE engineers.

The War Dept permitted release of this information when announcement was made that the British have used Allied jet-propelled planes successfully against German robot bombs. GE is building the gas turbines for the American version of the revolutionary-type aircraft, described as a single-seater high-altitude fighter.

GE engineers have this to say: "The jet plane turbines operate satisfactorily with either kerosene or gasoline, the former fuel having less tendency than gasoline to ignite in the open air. When the jet plane is in full flight, no visible flames come out of the exhaust. And because continuous ignition is not required, radio interference and high-altitude ignition problems are eliminated.

"The turbine is a compact, self-contained unit which has only one moving part. Air is taken into the turbine, compressed, and passed into chambers where its temperature is increased by the combustion of fuel, creating hot gases which are discharged through a tailpipe nozzle.

"Forward thrust of the plane is developed as the reaction to this high-velocity discharge in accordance with the physical law that for every action there is an equal

REPUBLIC HOSE
Built for *Service* and for *Punishment*

Technological advances in synthetic rubber have made possible recent improvements in Republic's outstanding Tower Pneumatic Hose. Its tube is compounded to resist oil and heat. Special braided cord reinforcing adds flexibility and strength for resistance against high working pressures, shock and crushing. The tough, abrasion-resisting cover will stand dragging over concrete floors, steelwork, rock, etc. Tower is a quality hose for use on pneumatic tools and air operated equipment, for mines, quarries, railroads, construction and road work, and for industrial uses. Consult your nearby Republic Distributor.

WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

BETTER THAN BEFORE

REPUBLIC RUBBER
DIVISION
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YOUNGSTOWN 1, OHIO

REPUBLIC INDUSTRIAL PRODUCTS
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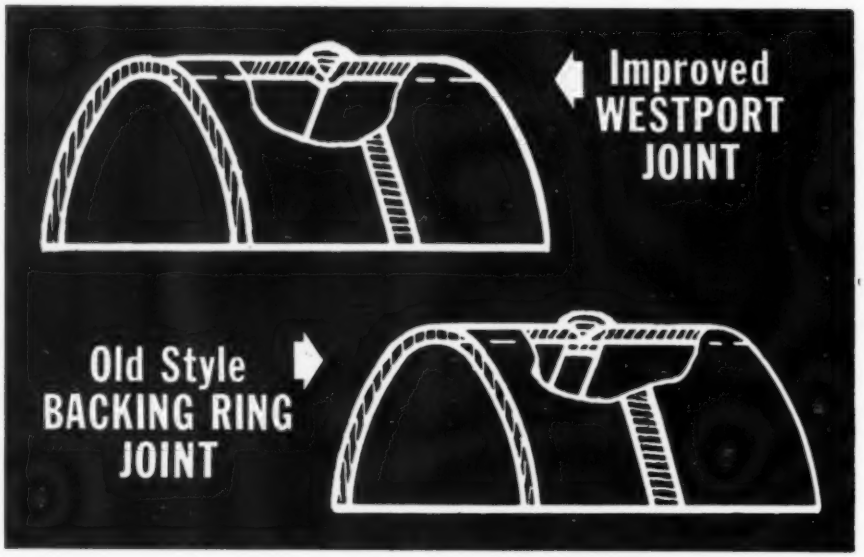
LEE DELUXE TIRES AND TUBES
CONSHOHOCKEN, PA.

Don't Weaken Your Pipes By Welding Them Wrong



THE WESTPORT JOINT

Produces *SOUND* Welds

Here's why The Westport Patented Joint welding permits fusion buttwelded joints to be made from one side only, with complete penetration to the root of the weld. This new method . . . especially suitable in the welding of heavy wall piping for high pressure temperatures . . . is proving satisfactory in lines operating at 1250 pounds per square inch and 925 degrees F. total temperature steam service, on installations made as early as 1939.

The Westport Welded Joint provides:

(1) Greater Flexibility in Alignment of pipes, valves and fittings.

(2) Complete penetration to root of weld.

(3) No constriction in pipe area due to Backing Rings.

(4) No sacrifice in strength of the pipe due to removal of wall or Backing Ring.

(5) Smooth pipe contour at base of weld with no "icicles" or protrusions.

(6) Meets A.S.M.E. Code Requirements.

1899 1944

WRITE FOR BULLETIN AND DETAILED LITERATURE WITHOUT DELAY

W. K. MITCHELL & CO., Inc.

PHILADELPHIA 46, PENNA.

and opposite reaction. A common example of this principle is the rotary lawn sprinkler, which is rotated in one direction by jets of water directed in opposite direction."

Lamp and lighting equipment manufacturers of the U. S. will join together next April 19 to 23 in the International Lighting Exposition at the Palmer House in Chicago to review newest developments in lamps and lighting equipment for industrial plants, schools, offices, stores and similar locations, and at same time show how better lighting is speeding production and helping win the war.

Ordnance Department of U. S. Army has authorized Monsanto Chemical Co to design, build and operate a factory for production of a new ordnance development. The plant, estimated to cost about $8,000,000, will adjoin the Longhorn Ordnance Works at Karnack, Texas. First unit will occupy about 2000 acres. When in operation, plant will have a personnel of about 700. It will operate as part of Monsanto's Organic Div, under D L Eynon, plant manager of Longhorn Works.

Henry B Bryans, executive vice-president and director of Philadelphia Electric Co, was reelected president of American Standards Association.

Other officers elected are the following: *Vice-President*: George S Case, Chairman of board of Lamson & Sessions Co (reelected); *Chairman, Standards Council*: H S Osborne, American Telephone and Telegraph Co (reelected); *Vice-Chairman, Standards Council*: E C Crittenden, National Bureau of Standards (reelected).

Postwar plans for Manitoba include an extension of province-owned hydroelectric system, estimated to cost between $20,000,000 and $30,000,000. Service would be extended to all towns in province and would be carried across fields to farms.

Resources Minister J L Phelps of Saskatchewan recently announced that a 13-year-old survey of a projected $18,000,000 hydro undertaking at Fort a la Corno on Saskatchewan River would be brought up to date, in line with government plans to make cheaper power available in the province to encourage industrial development and facilitate extension of rural electrification. J M Taylor, Saskatoon city electrical engineer, in a prepared report, declared the project would confer an immediate benefit on Saskatchewan in cheaper power only if government bore a third of cost, with remaining two thirds being financed by 3% debentures. Cost of scheme with a transmission system linking steam plants of the cities was set originally at $18,000,000, but Mr Taylor estimated plant and transmission costs would be about $3,000,000 higher today.

Vancouver Iron Works Ltd received an order for manufacture and installation of a 20,000-psi watertube steam boiler for new half million dollar plant at Gypsum Lime & Alabastine Canada Ltd, at S Westminister, B. C.

ask yourself THESE QUESTIONS

Before Selecting a Piping Contractor

"Has he had extensive experience on jobs like mine?"

MIDWEST organization has erected piping for more than four decades and in that time has handled every type of piping job. Whether you have a power plant . . . a chemical or process plant . . . or whatever your piping needs may be Midwest offers you a wealth of experience on comparable jobs.

"Does his fabricating plant have all the facilities needed?"

MIDWEST has four modern pipe fabricating plants. Each is equipped for any kind of piping job: layout tables . . . bending equipment . . . work rotating fixtures for welding . . . special lap-forging machines . . . etc. You will find no better equipped pipe fabricating plants.

"Is his location convenient?"

MIDWEST plants are strategically located to give quick service to any part of the country. Each plant is a complete unit but they work together on large jobs where time limitations do not permit all fabrication in one plant.

"Are his organization and erecting facilities adequate?"

MIDWEST places a resident engineer with a permanent staff of supervising erectors on the job. All Midwest qualification welders are from our own shop organizations. Midwest carefully controls the flow of materials from drawing board to the complete installation.

"Has he kept abreast of recent piping developments?"

MIDWEST has done more than that . . . among Midwest developments are the Globack joint which greatly improved lapped joints, the Midwest saddle for better reinforcing branch outlets, and a complete line of pipe welding fittings. Midwest piping research is continuous.

"Can he be of any special help on my job?"

MIDWEST gives you the benefit of a thoroughly experienced organization prepared to offer the advantages of any new piping developments. Our wide experience in all kinds of pipe work often enables us to make suggestions which result in better piping at lower cost.

MIDWEST PIPING & SUPPLY CO., INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles • Subsidiary: Lumsden & Van Stone Co., South Boston 27, Mass. • Sales Offices: New York 7—30 Church St. • Chicago 3—645 Marquette Bldg. Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St.

PIPING FABRICATORS AND CONTRACTORS

DOLLAR EFFICIENCY—work done per dollar spent—measures the value of steam generation

Exclusive principles of combustion and design have given Cyclotherm an outstanding record of efficiency and economy among steam generators. Because of its combustion principles and design, Cyclotherm meets the dollar efficiency test throughout its wide power range (10 to 300 horsepower) in units that are both oil and gas fired.

Whether used for power, processing or heating, a Cyclotherm makes an enviable record in steam production per unit of fuel consumed.

Cyclotherm Steam Generators are fully automatic, strongly built and fully self contained. They will give you years of trouble-free service for they are designed and constructed for exacting service with a minimum of attention.

While the range of available units obviously cannot be on a peacetime basis, if you are planning immediate replacement, our engineers will gladly cooperate in meeting your needs. Any additional information desired will be supplied promptly.

100 horsepower Cyclotherm with electronic control

CYCLOTHERM
STEAM GENERATOR

AMES IRON WORKS
OSWEGO . . NEW YORK . . BOX 602

APPOINTMENTS

General Electric Co elects **R H Luebbe** as vice-president and general counsel to succeed late Darius E Peck. **Joseph E Kewley** retires as vice-president and general manager of lamp department at Nela Park and **M L Sloan** succeeds him. **David C Prince,** vice-president, will be in charge of GE laboratory. Change of management in apparatus department is announced: **E D Spicer,** former vice-president of apparatus mfg is on president's staff in N. Y. **William R Burrows,** vice-president since 1927, retires. **Roy C Muir** has become general manager of apparatus dept and **Earl O Shreve** will be on the president's staff in charge of relations with customers. **Dr C G Suits** has been elected vice-president in charge of research laboratory. **Dr W D Coolidge** retires as vice-president. **L D Fowler** has been appointed assistant sales manager of integral-horsepower ac motor section. **Richard Cutts, Jr, E J Wehrle,** and **E J Boland** have been appointed sales manager and **R H Mitchell** assistant sales manager. GE formed new chemical department with **Dr Zay Jeffries** as vice-president in charge. **N R Birge,** vice-president, responsible for operations of GE affiliated companies, has retired and will be succeeded by **L R Boulware.**

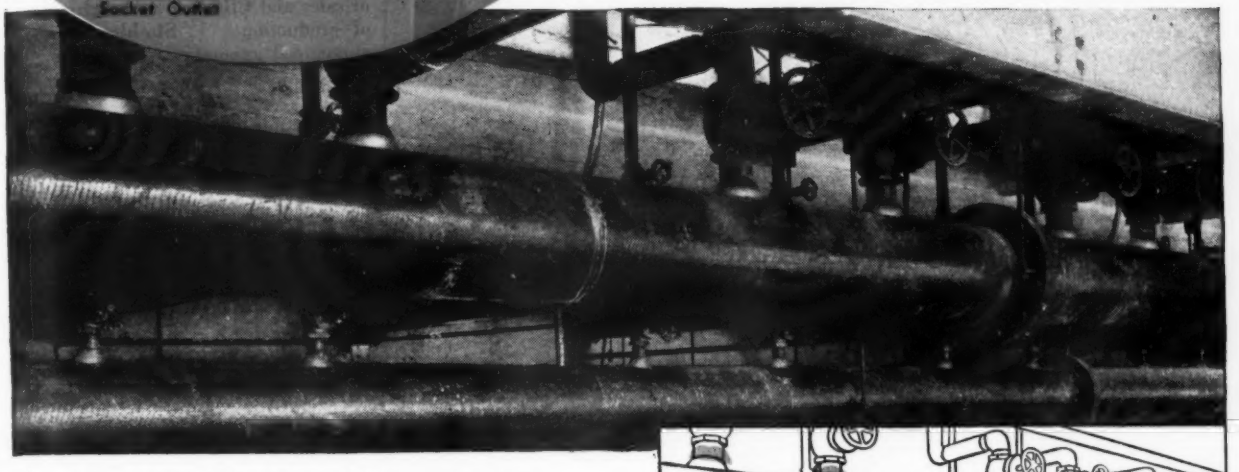
Stock of **Askania Regulator Co** has been acquired by **General Precision Equipment Corp.** Present management of Askania will continue in charge of operations. . . **Merwin T Farley** has been advanced to supervisor of parts depots of **Caterpillar Tractor Co.** . . **General Meters & Controls Co,** 205 W Wacker Dr, Chicago 6, Ill, was appointed district representative for northeastern Ill. and northwestern Ind. by **American District Steam Co,** manufacturers of Adsco products. . . **Drayer & Hanson, Inc,** Los Angeles, have leased entire building at 767 East Pico Blvd. . . **Harry B Higgins,** president of **Pittsburgh Plate Glass Co,** has been elected to board of directors of **Westinghouse Electric & Mfg Co.** . . **John C Straub** associated with research laboratories div of **General Motors Corp,** has been appointed research engineer of **American Foundry Equipment Co.**

General Controls Co announces appointment of **James King** as field sales engineer in New York factory branch. **Paul B Sagar** will be eastern field engineer. . . **Graybar Electric Co** has been appointed distributor for **Crosley Corp** in R. I. . . **Foxboro Co** announces appointment of **Wendell A Melton** as district manger in charge of Tulsa territory. . . **Stewart-Warner Corp** has appointed **Arden LeFevre** as vice-president and director of engineering; **Fred R Cross,** advertising manager; and **George W Oehlsen, Jr.** assistant director of engineering.

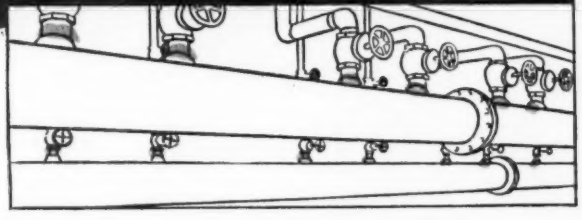
U. S. Gauge Co is relocated at the Monadnock Block, 53 Jackson Blvd, Chicago 4, Ill. **Walter H Magee** will be the district sales manager. . . **Sill & Warrington,** engineers, announce removal of their office to 79 Milk St, Boston 9, Mass. . . **P G McAusland** has been elected treasurer of **Reliance Electric & Engrg Co.** He

WeldOlets are available in three types—Welding Outlet, Threaded Outlet and Socket Outlet

WELDOLETS *Reduce* PIPE OUTLET COSTS



This is a partial view of two 500' steam lines where approximately 400 outlets were made by the WeldOlet method. A tremendous saving was made in installation costs because no forming or fitting operations were necessary in the run or branch pipes.



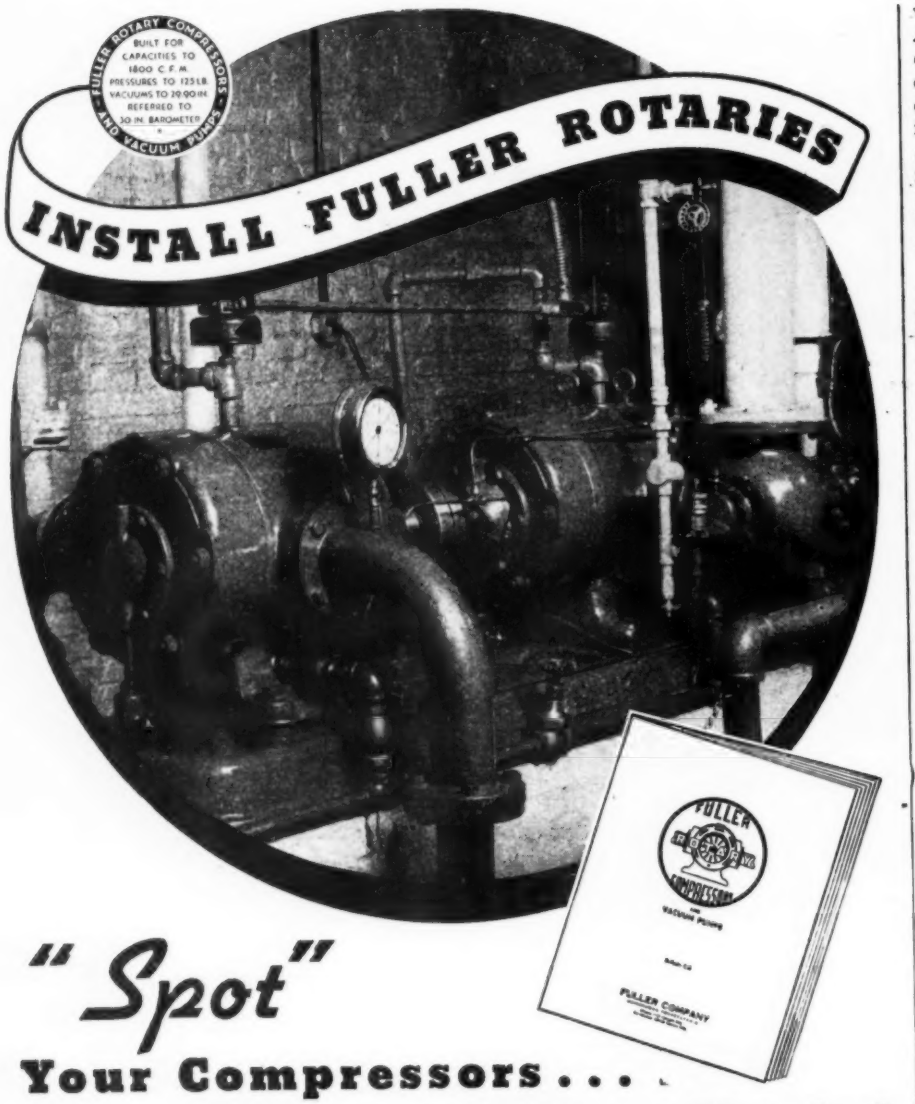
Making branch outlets on supply lines is simplified by the WeldOlet method. By this method you eliminate the necessity of cutting out a section of the run pipe and shaping the end of the branch pipe.

With the WeldOlet method it is only necessary to position the outlet on the run pipe, mark and cut the hole and weld the fitting in place. The result is a leakproof joint of full original pipe strength due to the reinforcing rib section of the fitting. In addition, efficient flow is maintained because the funnel shaped inlet of the fitting reduces turbulence and friction.

WeldOlets are made in size-to-size and reducing sizes for pipe up to 24" and for pressures up to 400 lbs. at 750° F. On your next piping job, specify WeldOlets. Write for illustrated catalog containing complete information on the uses, applications and advantages of WeldOlets.

Forged Fittings Division • **BONNEY FORGE & TOOL WORKS** • ***342 Green St., Allentown, Pa.***

WELDOLETS
TRADE MARK REG. U. S. PAT. OFF.
PAT. IN U. S. & FOREIGN COUNTRIES
WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET
For Welded Branch Pipe Outlets


FULLER ROTARY COMPRESSORS
BUILT FOR CAPACITIES TO 1800 C.F.M. PRESSURES TO 125 LB. VACUUMS TO 29·90 IN. REFERRED TO 30 IN. BAROMETER
AND VACUUM PUMPS
INSTALL FULLER ROTARIES
FULLER
VACUUM Pumps
FULLER COMPANY

"Spot" Your Compressors . . . Air . . . Where and When Needed

WHY continue the old custom of compressing air at one central point, using large-size, high-pressure units, working on pressures equal to the highest demand from any part of the plant?

WHY compress air to a hundred pounds, or even higher, and then reduce it to lower pressures at the point of use?

WHY use long distance pipe lines, with consequent leaks, and pay the added expense to prevent such leaks?

WHY pay out in power bills the excessive cost of forcing air through long transmission lines? Friction losses are *direct* losses.

WHY take up valuable floor space and construct heavy, costly foundations?

WHY waste money when these objections, and many others, can be eliminated by installing Fuller Rotary Compressors?

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA

Chicago 3 · 1144 Marquette Bldg.
San Francisco 4 · 421 Chancery Bldg.
Washington 5, D. C. · 618 Colorado Bldg.

No. 1 of a series

C-109

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

will continue to serve as comptroller. . . **American Engineering Co** announced consolidation of all the company's varied engineering functions into one engineering department. **H E Preston** is vice-president in charge. . . **Cardox Corp** has announced appointment of **J H Krallmann** as district manager of eastern New York, northern New Jersey and New England. **William C Powell** will succeed him as manager of Ohio, Ind. and Kentucky.

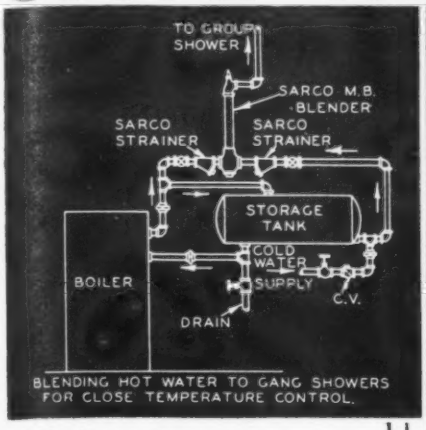
Vaughn-G E Witt Co and **Rucker Equipment Co** merged to form the **Rucker-Vaughn Co.** It is located at 300 17th St, Oakland and the factory is in Emeryville. **Clark E Rucker** is in charge of sales and **Clifford S Vaughn** in charge of production. . . **Sheldon Service Co** announced appointment of **Edgar Hubert** as New England sales manager. . . **Wilson A Charbonneaux** is manager and chief engineer of **Automatic Control Engineers,** Burlington, Iowa. . . **Mr Frank Gawan** has joined **Joy and Cox** as sales engineer. . . **Optimus Detergents Co** has been organized at Matawan, N. J. **Shook Bronze Corp** announces election of **Alan Dale** as vice-president in charge of sales. . . **Ray Oil Burner Sales, Inc,** announces that **Way-Wolff Associates** will handle Ray industrial, commercial, marine and domestic oil burners and oil-burning equipment.

Reliance Electric & Engrg Co announces appointment of **Edward E Helm** as general sales manager. **Kenneth S Lord** succeeds him as manager of Philadelphia district. . . **O B Wilson** has been named New York industrial manager for **Brown Instrument Co.** **J A Robinson** will succeed him as manager of Chicago branch. . . . **Allen K Snyder** rejoined **Carrier Corp** as staff assistant to **Les M Beals,** director of advertising and sales promotion. **N Stuart Irwin** has been appointed assistant director of advertising and sales promotion. . . **Harry Pastre, E W Appleton** and **E L Davis** were among 160 charter members of newly formed **Veterans' Association** who attended first annual banquet of organization at Jeannette, Pa. . . **Walter G Dieter** has been named sales promotion manager of **Darling Valve & Manufacturing Co.**

Sylvania Electric Products, Inc, has appointed **Stuart Goodwillie** as manager of central station sales in lighting div. . . **J E Smith** has joined **Wickwire Spencer Metallurgical Corp** as foreman of fabricated parts dept. . . **Jones & Laughlin Steel Corp** purchased their electric welded tube plant at Oil City, Pa., from **Talon, Inc.** It will be known as electric weld tube div and will be operated with present personnel. . . **H C Allington** has been appointed assistant general sales manager of **Wickwire Spencer Co.** . . **National Supply Co** has announced election of **E H Thorsteinson** as vice-president and controller.

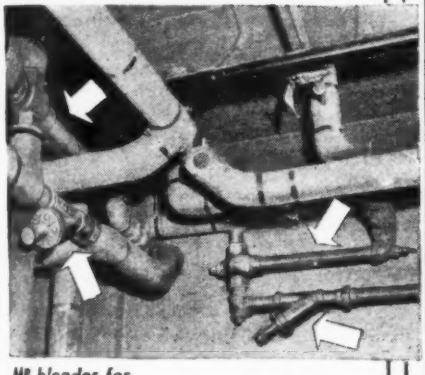
Austin R Zender, director of sales at **Bridgeport Brass Co** has been named vice-president in charge of sales. . . **Continental Foundry & Machine Co** has appointed **W R Duda,** vice-president in

SAVE HEAT AND WATER

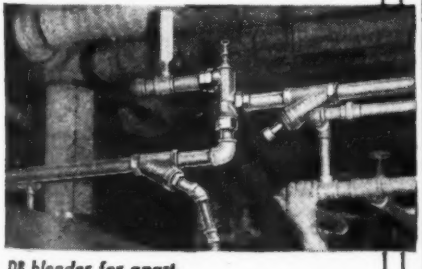


BLENDING HOT WATER TO GANG SHOWERS FOR CLOSE TEMPERATURE CONTROL.

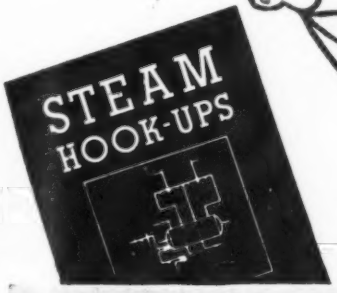
MB blenders on gang showers



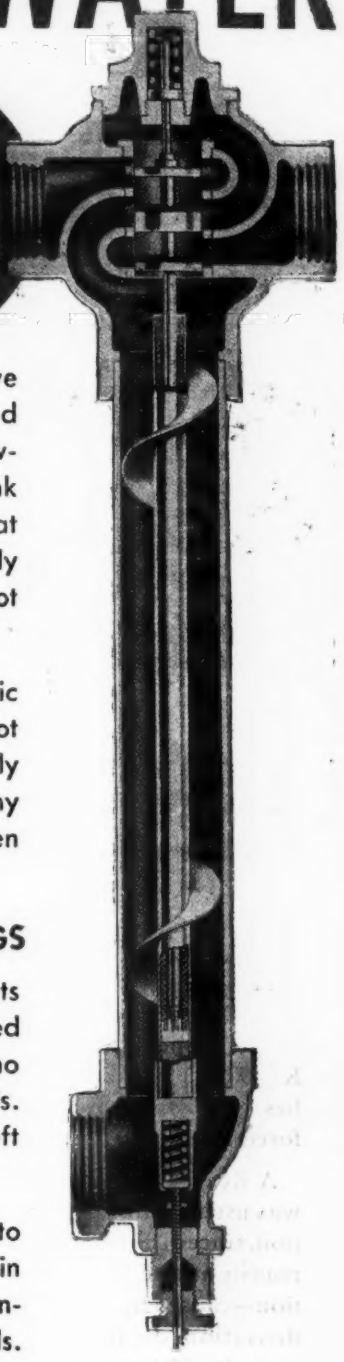
MB blender for process water



DB blender for apartment hot water line



SARCO MB BLENDER



When you save hot water, you save three ways: with less water and heat, you can render a better service in process, shower or rinse tank operations. The Sarco Blender at the right is one of three distinctly different methods of Sarco hot water control.

It is a simple, sturdy thermostatic mixing valve. By adding cold to hot water available, it automatically provides blended water at any temperature for which it has been set by the user.

IN COMMERCIAL BUILDINGS

Hot water complaints from tenants and employees are the dreaded daily routine of the engineer who is not protected by Sarco Controls. The Sarco Blender shown at the left eliminated all complaints.

The Sarco Blender is used also to regulate flow of cooling water in jackets of internal combustion engines or of brine in cooling coils.

Available in sizes ½ to 4", for pressures up to 150 lbs., 0° to 200° F. See Catalog No. 802.

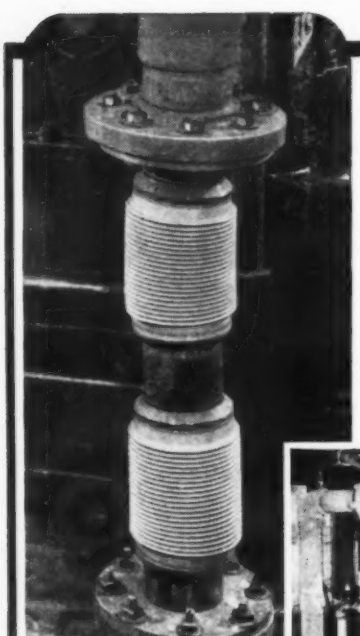
32

SARCO COMPANY, INC.
475 FIFTH AVENUE
NEW YORK 17, N. Y.

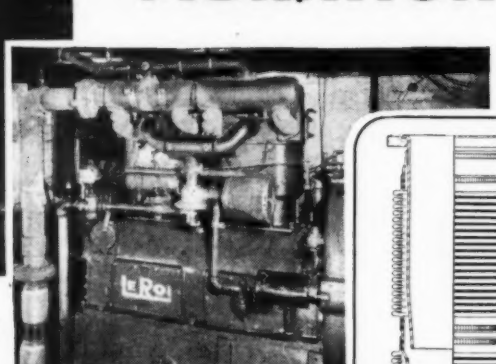
Represented in Principal Cities

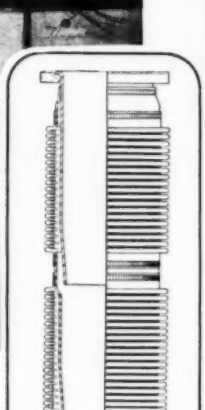
SARCO Saves Steam

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO



EXCESSIVE CORROSION + VIBRATION





demand

REX-FLEX Stainless Steel-lined exhaust units

Excessive heat, corrosion and vibration require an exhaust unit that is *durable.* Gas engines, especially, demand a Rex-Flex lined exhaust unit to best withstand these destructive forces.

A Rex-Flex *stainless-steel* unit was used in the above installation, since ordinary steel is more readily affected by corrosive action—caused by acidulated condensation during shut-down periods. Through the use of a lined Rex-Flex exhaust unit, a smooth bore flow was obtained—undesirable back pressures were avoided and longer unit life was assured. Flexibility was increased also, due to the Rex-Flex method of attaching the liner, which allows complete freedom of axial and radial motion within specified limits.

No matter what your exhaust connector needs are—now or in the future—you can increase operating life and efficiency with Rex-Flex Stainless-Steel lined exhaust units. Send your installation requirements to our Engineering Department—now.

Flexible Metal Hose for Every Industrial Use

ARMY E NAVY

CMH CHICAGO METAL HOSE CORPORATION

MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

charge of engineering; **W L Berghoefer,** vice-president in charge of casting sales; **B P Hammond,** manager of casting sales in Pittsburgh district. . . **Horace A Green** has been appointed to represent **Modine Mfg Co** in Missoula, Montana. . . **W Spencer Robertson,** president of **Permutit Co** was elected chairman of board. . . **Henry W Foulds,** who has been a vice-president, is the new president.

J E Moore and **Paul Valle** have been appointed deputies to **V M Marquis,** director of **Office of War Utilities'** power div replacing **B J Sickler** who resigned. . . **E. Robert de Luccia** has been named chief of **Federal Power Commission's** bureau of power under which former bureaus of water power and electrical engineering are consolidated. . . **Charles F Weiler** has been named deputy director of **OWU;** his job as assistant to director was filled by **Herschel F Jones.** . . **Roland A Wank** has resigned as head architect of **Tennessee Valley Authority** to join designing staff of **Albert Kahn Associated Architects & Engineers, Inc.** . **Herbert B Reynolds** has been given duties of superintendent of power generation for the **Interborough Rapid Transit Co, Brooklyn Manhattan Transit Co** and **Independent System.**

H S McPherson has been appointed midwestern sales manager of mechanical goods div of **United States Rubber Co** and **W M Ballew** has been shifted to post of southwestern sales manager. **John Blake** has been appointed manager of marine cable sales. . . **Wickwire Spencer Steel Co** announced that accounts receivable, accounts payable and credit departments will be located at River Road, Buffalo. **R L Hoenstein** was appointed superintendent of Mt Wolf, Pennsylvania plant. . . **Rockbestos Products Corp** announced the resignation of **Kendall A Redfield,** asst general sales manager, to become president of **Associated Seed Growers** export div; **Edward M Heery,** asst advertising manager, advanced to advertising manager; **Robert B Lattin,** factory manager, became technical director; **Stephen S. Nichols,** asst factory manager, advanced to factory superintendent.

Crane Co announces retirement of **D D Updegraff,** manager since 1936. He will be succeeded by **R E Penny** who in turn will be replaced by **L R Bauer** in Jacksonville. **J J Murray** was appointed manager in New Haven. **O F Woodyard** succeeds **F A Duncan,** manager in Memphis, Tenn. for 43 years, after his retirement. **A C Gribble** becomes manager at Little Rock, Ark. . . **McClave Co** cancelled sales agency agreement with **Automatic Coal Burner Co.** All business is transferred to Philadelphia office at 1600 Arch St. . **Blaw-Knox Co** promotes **Paul J Wolfert** to export department engineer.

Clark Bros Co announce appointment of **T F Hudgins** as N. Y. export manager and **R R McCartney** N. Y. district manager. **Val R Wittich, Jr** resigns after 15 years with company. New offices are located at 122 E 42nd St, New York. . . **Blackmer**

Above: The Yarway Remote Liquid Level Indicator for mounting on wall or building column.

Below: Two Yarway Liquid Level Indicators mounted on instrument panel of prominent high pressure New Jersey Utility.

Now...

MORE ACCURATE READINGS OF BOILER WATER LEVELS

"Positive as the Law of Gravity"

The Yarway Remote Liquid Level Indicator offers you this on a brightly-lighted scale right on your instrument panel or at any other convenient location. No more guessing at hard-to-see gages. No more risk of serious damage to equipment due to inaccurate water level readings. *Now double-check your overhead gage readings with this Yarway Eye-level Instrument.*

Its accuracy and dependability are "positive as the law of gravity" for this instrument literally "weighs" the difference between a constant column of water and the varying level in boiler drum and indicates the difference by pointer movement over a calibrated scale.

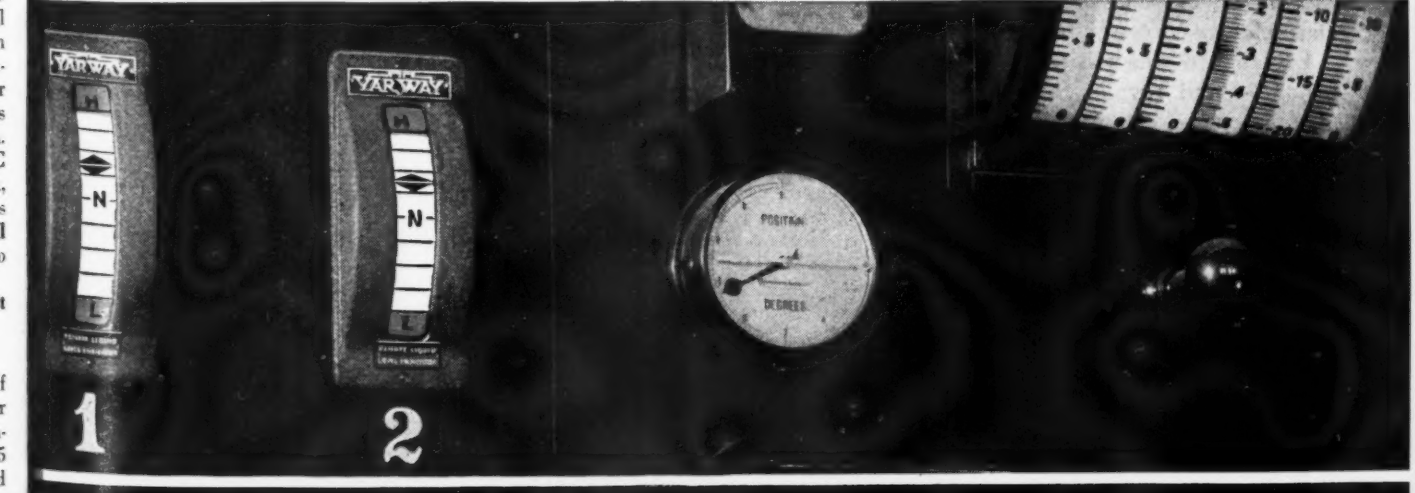
Indications are instant. The luminous pointer follows the water level constantly—is always visible, even in complete darkness. The indicating mechanism is never under pressure—is frictionless—is perfectly balanced on jewelled bearings. *There are no stuffing boxes.* Indicating and actuating mechanisms are completely separated, but operate simultaneously through a powerful, permanent magnet transmission.

Accelerated endurance tests in the Yarway Steam Laboratory have duplicated 50 years of normal boiler service without need for repair, replacement of a single part or recalibration.

Easily installed on new or existing boilers or other equipment requiring liquid level indication.

Suitable for pressures up to 1500 lb. Hundreds have been purchased and repeat orders indicate enthusiastic user satisfaction. Write for Bulletin WG-1820.

YARNALL-WARING CO. 100 Mermaid Ave., Phila. 18, Pa.



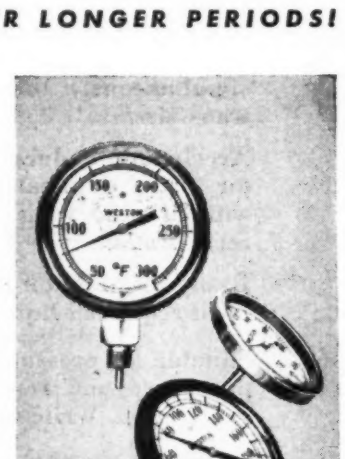
YARWAY REMOTE LIQUID LEVEL INDICATOR

Eyes RIGHT!

WESTON'S ALL-METAL TEMPERATURE PRINCIPLE ASSURES DEPENDABLE READINGS, *OVER LONGER PERIODS!*

The *long-term* dependability of the WESTON thermometer stems from its rugged, all-metal construction. It consists of only a simple, durable all-metal temperature element safely encased in a stainless steel stem. No gases or liquids, no capillary, no complicated mechanical linkages, no fragile parts are employed. Because of this extreme simplicity, and the absence of so many common trouble points, WESTONS maintain their high initial accuracy *over far longer* periods. Thus they provide better protection for processes and equipment, and keep replacement and maintenance costs at a far lower level.

Literature describing these dependable and rugged thermometers, including types, stem lengths, prices, etc., gladly sent on request. WESTON Electrical Instrument Corporation, 679 Frelinghusen Avenue, Newark 5, N. J.



WESTON All-Metal Temperature Gauges are available in sizes and types for most industrial needs . . . as well as in laboratory models with full scale accuracy within ½ of 1%.

WESTON *All Metal* TEMPERATURE GAUGES

Pump Co appoints **Fred T Kennedy** general manager. . . **Busch-Sulzer Bros-Diesel Engine Co** has appointed **Joseph G Broz** vice-president in charge of sales and **Charles E Beck** sales manager. **Independent Pneumatic Tool Co** announces retirement of **W H Brewer,** general manager, after 36 years with plant.

CURRENT AWARDS

Goulds Pumps, Inc, received Army-Navy "E" Award. **Carboloy Co** was awarded a star for its "E" pennant. **Trackson Co** has added a second star to its flag.

Craftsweld Equipment Corp has been awarded a third Army-Navy "E" pennant. Manhattan Rubber Mfg Div, of **Raybestos-Manhattan, Inc,** gets third Army-Navy "E" award.

Kewanee Boiler Co won Army-Navy production award for fourth time. **H M Harper** won fifth Army-Navy "E" award.

Edison Medal for 1944 has been awarded by American Institute of Electrical Engineers to **Dr Ernst Fredrik Werner Alexanderson,** consulting engineer, General Electric Co.

OBITUARIES

Paul M Downing, 71, executive vice-president of Pacific Gas & Electric Co, died Dec 11. He had been with the company for 43 years.

Dr C F Scott, 80, former Yale professor, died December 17. He was chairman 22 years of University's electrical engineering department and consulting engineer of Westinghouse Electric and Mfg. Co.

Arthur N Goff, 68, dean of Modine representatives, died in Fond du Lac December 24.

George S Whyte, 77, founder and board chairman of Macwhyte Co, died at his home Dec 15 of a heart attack. He was widely known as an industrialist, civic leader and philanthropist.

Darius E Peck, vice-president and general counsel of General Electric Co, died Dec 6 following a heart attack. He was 67.

Howard McWilliam Wylie, vice president in charge of sales for Nash Engineering Co, died December 25 after a long illness. He was 59.

Don R Marsh, 63, factory manager of Buffalo Forge Co, died suddenly at his home Dec 21.

CED Book to Help Build Small Business

What each community can do for postwar prosperity of its own small business concerns, and how to go about it, is the subject of a *CED Community Handbook on the Special Problems of Small Business,* issued by Committee for Economic Development. Book will help to guide efforts of 2000 local CED committees in all parts of the country to stimulate creation of new businesses to help existing small businesses grow larger and stronger.

Take it from the G.I.'s

[Signal Corps Photograph

THEY KNOW! Better perhaps than anyone else in the world, today's G.I.s know the importance of efficient diesel operation. Almost without exception, landing craft all over the world are powered by diesels.

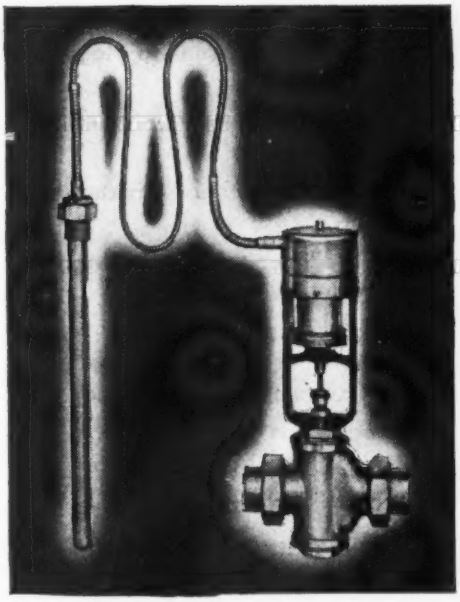
Engineers agree that thermostatic control is the only way surely to safeguard against diesel temperature fluctuations—the only way to assure stability and maximum performance. In modern diesels, jacket temperatures should remain constant with only a small variation from base to cylinder head.

Sylphon Diesel Controls are designed to maintain constant jacket temperatures regardless of load or engine speed changes.

Self-operating, with no electrical connections, they utilize minute temperature changes in the coolant to govern its flow. Inexpensive. Adaptable to *any* type of diesel installation.

Write for Bulletin CS-817 giving full information together with many typical applications.

NEW MOVIE—"The Story of Metal Bellows" is available to interested executives and organizations.



923 SYLPHON REGULATOR. This device automatically eliminates necessity for manual water supply control. Maintains efficient operating temperature, insuring fuel economy, vastly improved performance.

FULTON SYLPHON

TEMPERATURE CONTROLS BELLOWS . . . BELLOWS ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Canadian Representatives, Darling Brothers, Montreal

YARWAY INVOLUTE SPRAY NOZZLES

Unique Yarway Involute design.

No internal parts or vanes to clog or erode.

Unobstructed flow gives minimum loss of head.

Finely divided spray cone provides rapid cooling.

Renewable orifices adapt nozzles for any service.

Installations total more than 5 million gallons per minute in water cooling and air conditioning service.

Made in both cast and bar-stock types. All sizes from 1/4 in. to 2 1/2 in. Write for Catalog N-616.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

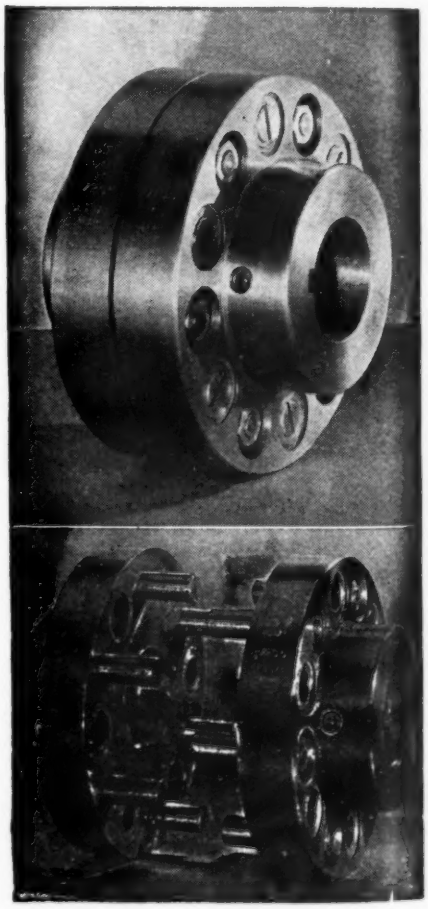
This 10-second test will quickly show you why a flexible coupling is mighty important to the life of direct-connected machines.

Just try to hold a couple of pencils in perfect alignment without touching each other and see what happens.

Ajax Flexible Couplings provide a positive but resilient connection between driving and driven shafts. They make it possible for each shaft to rotate around its own axis without creating vibration, chatter, strain on bearings, drag, power loss, reversal of torque and other detrimental factors.

Ajax interlocking drive studs held by rubber-bushed graphited bronze bearings assure maximum flexibility, quiet operation, and complete elimination of lubrication problems.

Make the 10-second "pencil test"—then write for Facts on Ajax Flexible Couplings.



AJAX

Flexible Coupling Co., Inc.
WESTFIELD, N. Y.
Incorporated 1920

TO MAKE GOOD CASTINGS

And Sivyer has these men . . . experienced men . . . men who have spent years in the casting business . . . who have lived with castings and know all there is to know about them.

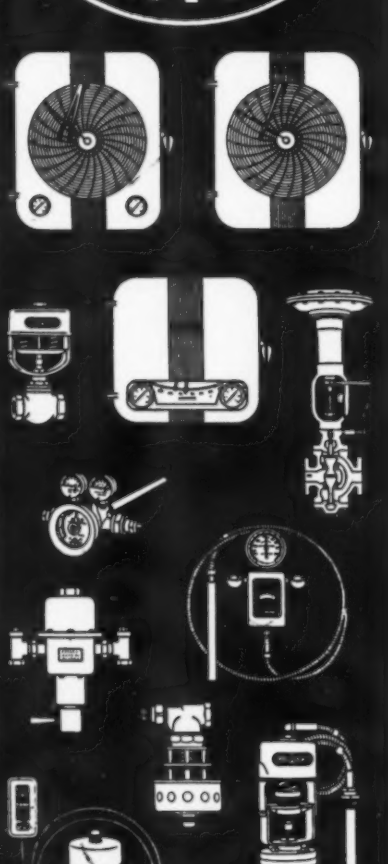
Yes, it's these old-timers who so greatly help make Sivyer steel castings . . . better castings. Hand in hand with this human experience, goes the most modern in scientific foundry methods . . . the finest in equipment. Adding these together, you have the reason why particular users prefer steel castings bearing the Sivyer diamond —the mark worth looking for.

SIVYER STEEL CASTING COMPANY
MILWAUKEE CHICAGO

ARMY E NAVY

POWERS

TEMPERATURE and HUMIDITY CONTROL



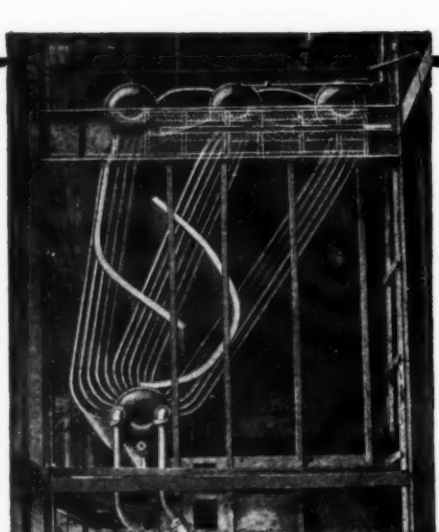
When you want accurate and dependable automatic temperature or humidity control for Industrial Processes, Heating or Air Conditioning Systems, call in a Powers engineer. With over 50 years of experience and a very complete line of self-operating and air operated controls we are well equipped to fill your requirements.

Write for Circular 2520

2721 Greenview Ave., Chicago
Offices in 47 Cities—See your phone directory.

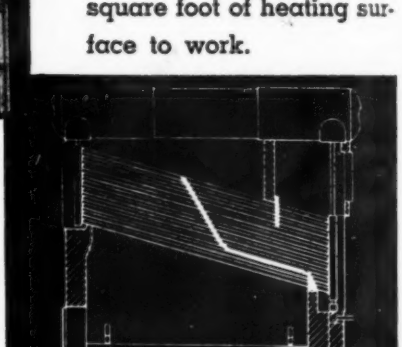
THE
POWERS REGULATOR CO.

MORE STEAM



QUICKLY EASILY

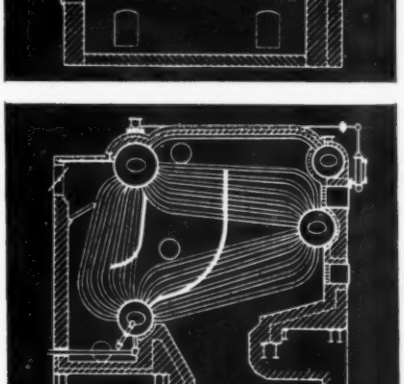
Steam output can be boosted quickly and easily by installing Enco baffles. These streamlined baffles prevent eddy currents and dead gas pockets. The cross-flow puts every square foot of heating surface to work.



Enco baffles reduce draft loss by doing away with bottlenecks in the passes. They save steam because soot blowers are more effective and used less often.

Each application is individually designed on the basis of 25 years experience with Enco baffling in all types of water-tube boilers.

Installations are made by skilled mechanics with selected materials.



FREE BOILER BAFFLES

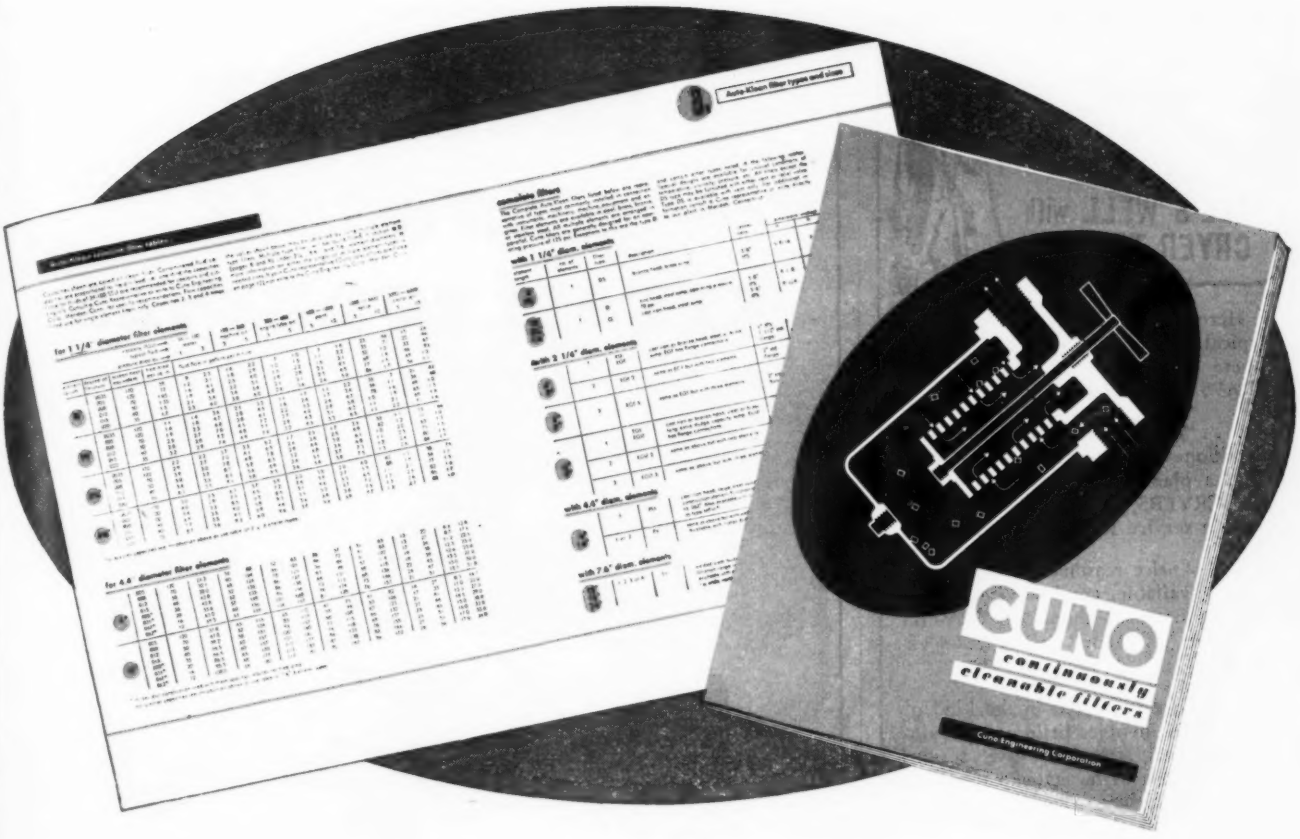
● *A bulletin on boiler baffles gives valuable information which every engineer should have. Ask for bulletin BW 40. It's free.*

THE ENGINEER COMPANY

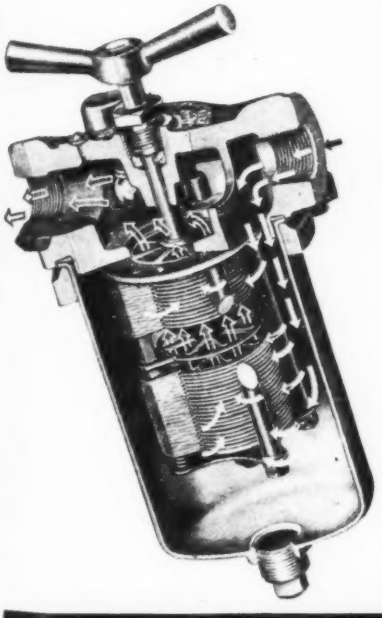
75 WEST STREET • NEW YORK, N. Y.

Enco Streamline Baffles

PRODUCED EXCLUSIVELY BY THE ENGINEER COMPANY



HOW TO SELECT THE FILTER THAT KEEPS FLOW ON "GO"



Send for this catalog of filter selection factors and specifications on Cuno Continuously-Cleanable Filters. (It's in SWEET'S MECHANICAL, PROCESS AND DESIGN FILES, but you may like an extra copy.) It gives you the information you need, arranged according to the recommendations of SWEET'S catalog designers, who learned from men like you how you want such information furnished.

In a word, the Cuno Continuously-Cleanable Filter handles full flow without requiring any more space than ordinary partial-flow types . . . filters as fine as 170 mesh equivalent (finer with certain models) . . . filters continuously, even while being cleaned . . . is applicable to low pressure or gravity feed systems (as well as others) . . . is all-metal, non-collapsible, permanent . . . is compact and lightweight . . . never needs to be disassembled for cleaning or renewing. May be equipped with motor to make cleaning completely automatic.

More about all that in the catalog — plus application listings, selective flow tables, types, sizes, dimensions and capacities. If you wish an extra copy of the insert in SWEET'S, send the coupon.

IF YOU HAVE "QUICK FACTS", YOU'LL ALSO WANT THIS
Cuno's booklet of "Quick Facts" is mostly about applications. This catalog is mostly about filter selection "know-how". You should have both.

KEEP FLOW ON "GO" WITH
CUNO
THE "FILTER-FINE" STRAINER

CUNO ENGINEERING CORPORATION
222 South Vine St., Meriden, Connecticut
Please send me a free copy of your selection and specification catalog.

Name .....
Company .....
Address .....
I also would like "Quick Facts" . . . ☐

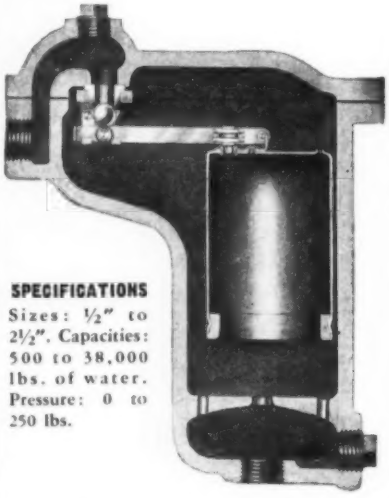
USERS agree in saying "ALL'S WELL with CRYER TRAPS"

Here are a few recent typical reports from plants where CRYER BUCKET TYPE TRAPS are in service.

. . . . "they stand up under most any conditions—need very little care" (this from a plant using between 150 and 200 CRYERS, some of which have been in service for ten years).

. . . . "price reasonable, spare parts always available, good service" (from a plant that uses about 500 CRYERS and bases its report on five years experience).

If you are interested in the kind of service that involves little or no maintenance and attention, give serious consideration to the actual experience of CRYER users. These plants are definitely sold on CRYERS for all applications. From all sides we get the same story "All's Well with CRYER TRAPS."



SPECIFICATIONS
Sizes: ½" to 2½". Capacities: 500 to 38,000 lbs. of water. Pressure: 0 to 250 lbs.

We carry all sizes of traps and repair parts for the line formerly known as the J-M Ball Steam Trap.

CRYER TRAP & VALVE CO.

366 Madison Ave., New York, N. Y.

Manufacturers of steam specialties for over 40 years.

● MAIL COUPON TODAY

CRYER TRAP & VALVE CO.,
366 Madison Ave., New York, N. Y.

Kindly send full details on CRYER BUCKET TYPE STEAM TRAPS.

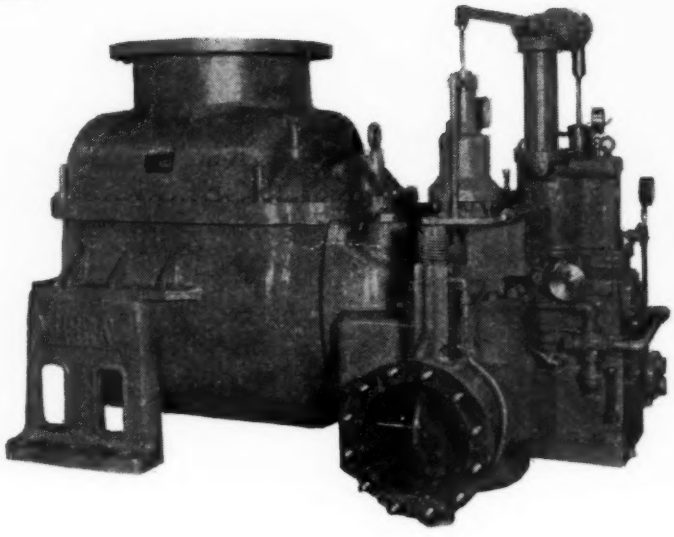
Name .....

Position .....

Company .....

Address .....

MURRAY
MULTISTAGE
STEAM TURBINES



Another MURRAY multistage steam turbine, designed to deliver 350 horsepower on low pressure steam at 5 pounds and exhausting to 26 inches Hg vacuum. It is provided with single inlet valve with 10 inch flange, and 24 inch exhaust facing up. This unit will pay for itself in a short time, since it utilizes what would otherwise be wasted energy, since an excess of low pressure steam existed.

Equipment includes variable speed oil relay governor, butterfly type emergency trip valve, strainer surrounding the double seated balanced governor valve.

The complete MURRAY line of turbines includes all variations of mechanical drives, and turbine generator sets up to and including 2500 KW rating.

Sales Representatives for Murray products are located in all principal cities.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

SIMPLIFIED SPEED CONTROL

A feature of
HENDY TURBO-GENERATORS

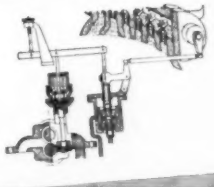
HENDY'S simplified governor system will pay you dividends

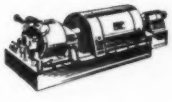
This governing system is positive in action—and extremely sensitive from no load to overload. It is a simplified and compact unit of the oil-relay and centrifugal type. An overspeed trip mechanism within the governor assembly automatically closes the throttle at 110% normal speed. Additional safety is provided by the hand-operated emergency trip button which, because of its location and method of operation, effectively prevents accidental tripping and purposeless shutdown.

Another new design feature of this governor system makes synchronization easy; through the use of a vernier-type screw, turbine speed-load characteristics can be accurately adjusted within a range of 5% above or below normal.

This simplified governor system is only one of many advanced Hendy features that pay you dividends in lower maintenance costs and efficient operation. Details of other dividend-paying features will follow in succeeding advertisements.

Hendy turbo-generators are available in sizes from 250 to 750 kw. When requesting detailed information, please indicate electrical requirements, steam conditions, and type of service involved. Phone or write your nearest Hendy office.





Because this new Hendy Turbo-generator is *simplified,* it is dependable and efficient. Not only have general characteristics been bettered, but individual parts have also been improved—made *simpler* and more dependable through ingenious design.

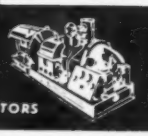
This is true of the set throughout. Turbine, reduction gear, and generator—all were designed and built as *matched* units. And *all* are built by Hendy, giving you complete power equipment from *one* responsible source.

Here are just a few of the features of this set: an extremely accurate governor mechanism that reduces maintenance because it has no packing or stuffing boxes . . . easy accessibility to all parts subject to wear or replacement . . . neat, trim contours and reduced external piping, made possible by the placement of filters, strainers, and controls in protected locations. These, and the many other features of this turbo-generator, combine to make a smooth-running, dependable power plant for a wide variety of industrial applications.

JOSHUA HENDY IRON WORKS
ESTABLISHED 1856
SUNNYVALE, CALIFORNIA

62-TG-7

Branch Offices: **BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON**

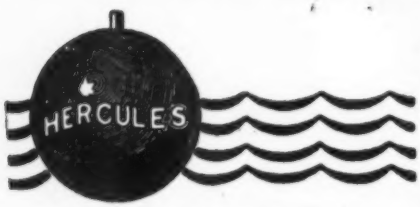

TURBO-GENERATORS

REDUCTION GEARS

STEAM TURBINES

DIESEL ENGINES

HERCULES
Seamless Copper
FLOATS



GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

ADAMANT
FIRE BRICK CEMENT
ADAMANT

HOLD COSTS DOWN

by laying up furnace linings with Adamant . . . the fire brick cement of proved great bonding strength.* Adamant actually welds the brick together . . . protects the construction at the joints where failure usually begins.

Adamant has been proven STRONGER by test . . . Impartial laboratory tests showed Adamant has a bonding strength of 800 lbs. at room temperature; 1270 lbs. at 2600° F. Adamant has a P. C. E. of 3000° F. plus. For more details, write

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

How to get efficient coagulation with no chemical feeding problems... SUMMER or WINTER!

IF you have ever had trouble getting the coagulant you are now using into solution during winter months when tap water temperatures are low, this chart reveals a simple, easy answer to your problem.

It shows how the natural heat of hydration of Ferrisul, Monsanto's efficient, flexible coagulant for water and sewage treatment, can be used to speed mixing with water *whatever the temperature of your tap water.*

Ferrisul, the only *anhydrous* ferric sulfate available for water and sewage treatment, is therefore the only ferric sulfate which creates heat when mixed with water. This means it is the only ferric sulfate that can be quickly and completely dissolved in cold water by simply adjusting your ferric sulfate : water ratio. (Mechanical agitation must be provided.)

Ferrisul Dissolves in 18-25 Minutes

For example, if your tap water is 40°F., one part of Ferrisul added to three parts of water will raise the temperature in your mixing pot to 92°F. . . . *and the Ferrisul will be completely dissolved in about 22 minutes.*

On the other hand, if your tap water is 80°F., you will want to add 10 to 15 parts water to one part Ferrisul . . . producing a temperature of 89° to 94°F. in the mixing pot . . . and dissolving the Ferrisul in 18 to 25 minutes.

Of course, no one is going to change to Ferrisul simply because it dissolves easily in cold water, *but this is just one of many advantages you enjoy when you specify coagulation with Ferrisul.*

Other Important Advantages

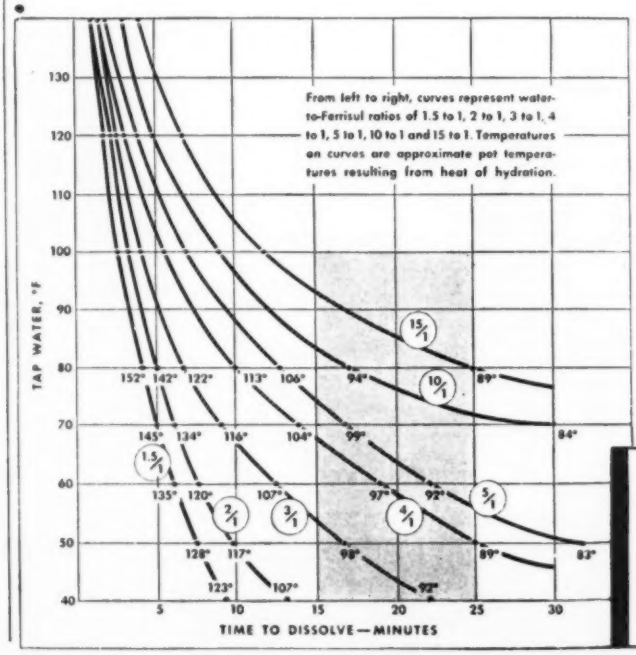
Because its floc forms rapidly . . . settles quickly . . . and is effective over the entire pH range above 3.5 . . . Ferrisul handles wide seasonal variations in raw water and even wider *daily* variations in sewage with maximum efficiency and a minimum change in treatment.

Dry and free-flowing, Ferrisul is easy to store and handle, will not cake in storage and requires little special equipment for proper application.

Has Highest Ferric Sulfate Content

A particularly important point, since the efficiency of any ferric sulfate coagulant is determined entirely by its ferric sulfate content, Ferrisul is the *only* commercial product which contains a minimum of 90% ferric sulfate.

To get started on plans for more efficient coagulation in your plant *now*, write *today:* MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston 49, Massachusetts.



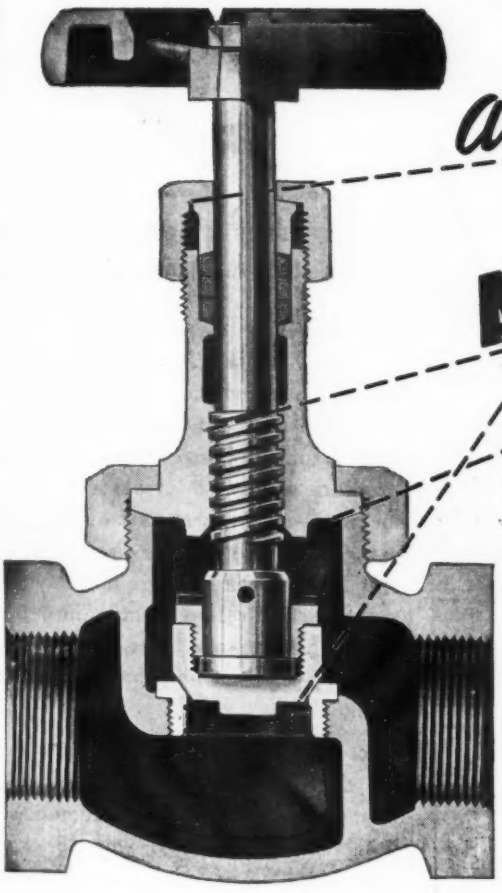
These curves show: (1) what temperature will be produced in the mixing pot by seven different Ferrisul : water ratios at the temperature of the water added varies, and (2) how long it will take Ferrisul to dissolve in each of the seven ratios illustrated as the tap water temperature varies. For best results, it is recommended that Ferrisul : water ratios be changed as the temperature of your tap water changes so that mixing pot temperatures will always remain between 89° and 100°F. (shaded area). In this way, Ferrisul will always be completely dissolved in 15 to 25 minutes. For more details on Ferrisul dissolving and feeding, write for the new, four-page leaflet, "Feeding Data for Ferrisul."

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

"Trifles make perfection but perfection is no trifle"

One of a series of advertisements explaining how Kennedy gives careful attention to the details of valve design, construction and workmanship that provide maximum effectiveness, convenience, and length of service.

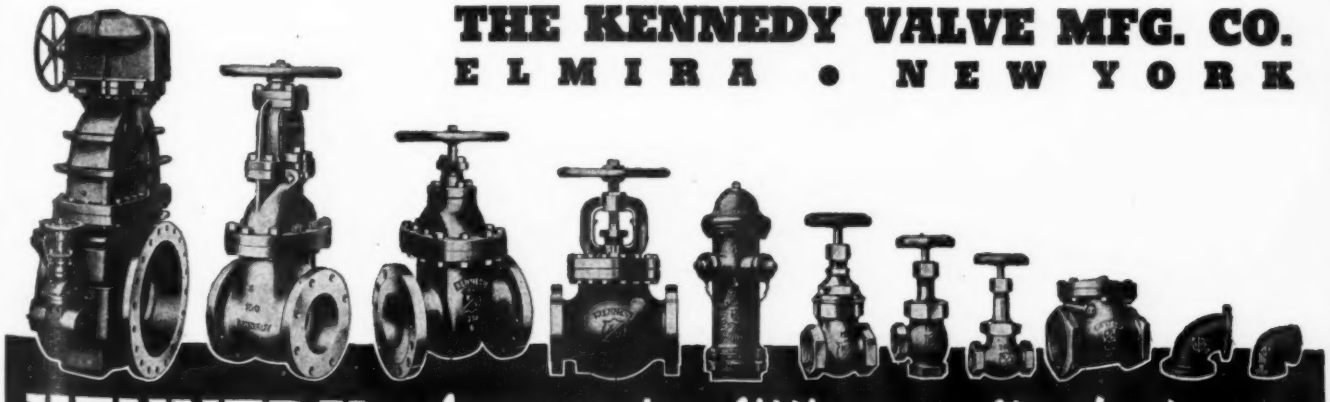
Why are all these ANGLES DIFFERENT



YOU are looking at a sectional view of a Kennedy 200-lb. bronze globe valve with full-way disc. Notice the different angularities at the metal-to-metal contacts between disc and seat ring, body and bonnet joint, packing nut and gland, and also the stem thread and bonnet.

These angles were not determined by "guesstimate" but by careful calculations checked by lengthy tests and actual service experience. It would have been easier to have made most of them uniform, but Kennedy doesn't do things that way. Each of these angles helps to give you, for its particular requirements, the tightness, plus convenience, plus long wear that provide extra values in all Kennedy Valves, and have impelled so many plants to standardize on them for over 60 years.

THE KENNEDY VALVE MFG. CO.
ELMIRA • NEW YORK



KENNEDY *valves... pipe fittings... fire hydrants*

STOP
wasting manpower in the boiler plant

● Here is a clean, automatic system of both coal and ash handling that is complete. Beaumont engineers take full responsibility from design to finished structure including all necessary equipment for handling coal from car to stoker and ashes from pit to truck.

The entire system is designed and built to individual requirements, at reasonable cost. Full details on Beaumont products and materials-handling systems upon request.

BEAUMONT BIRCH COMPANY

1502 RACE STREET PHILADELPHIA 2, PA.

DESIGNERS • MANUFACTURERS • ERECTORS OF COAL AND ASH HANDLING SYSTEMS

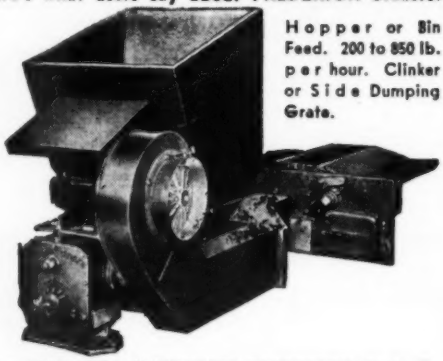
FREDERICK Stokers
. . . CUT DOWN WASTE

Do you get all the heat you pay for? Do you get every bit of heat out of every pound of coal? Here's what users say about FREDERICK Stokers:

Hotel Operator—"Satisfactory and efficient . . . saved one hundred tons of coal in one year."

Laundry Owner—"Present savings on fuel run greater than $1000 per year."

Apartment House Owner—"A Stoker cannot give more than a FREDERICK Stoker."



Hopper or Bin Feed. 200 to 850 lb. per hour. Clinker or Side Dumping Grate.

We have been Stoker Specialists since 1918. The IMPROVED FREDERICK Stoker line is the foremost stoker value in America because it is engineered to give the utmost in convenience AND EFFICIENCY. Write for further details . . . ask for our Stoker catalog.

IT WILL PAY YOU—When considering a Centrifugal Pump . . . to investigate FREDERICK Pumps . . . specially designed for efficient service in your industry. Engineering consultation available with no obligation.

THE Frederick IRON & STEEL CO.
Frederick, Maryland

STOKER SPECIALISTS SINCE 1918

No Other Refractory Coating Is Like BRICKSEAL

★ **Forms a highly-glazed, protective, monolithic surface**

Brickseal is the only refractory coating we know of which consists of high-fusion clays and metals combined with oils. Unlike air-set washes which form only a plaster-like coating on the refractory surface, Brickseal actually becomes an integral part of the brickwork. The heat of the fire-box drives out the oils and vitrifies the clays and metals, penetrating deeply into brick pores, cracks and joints, and forming a highly-glazed, air-tight, monolithic wall.

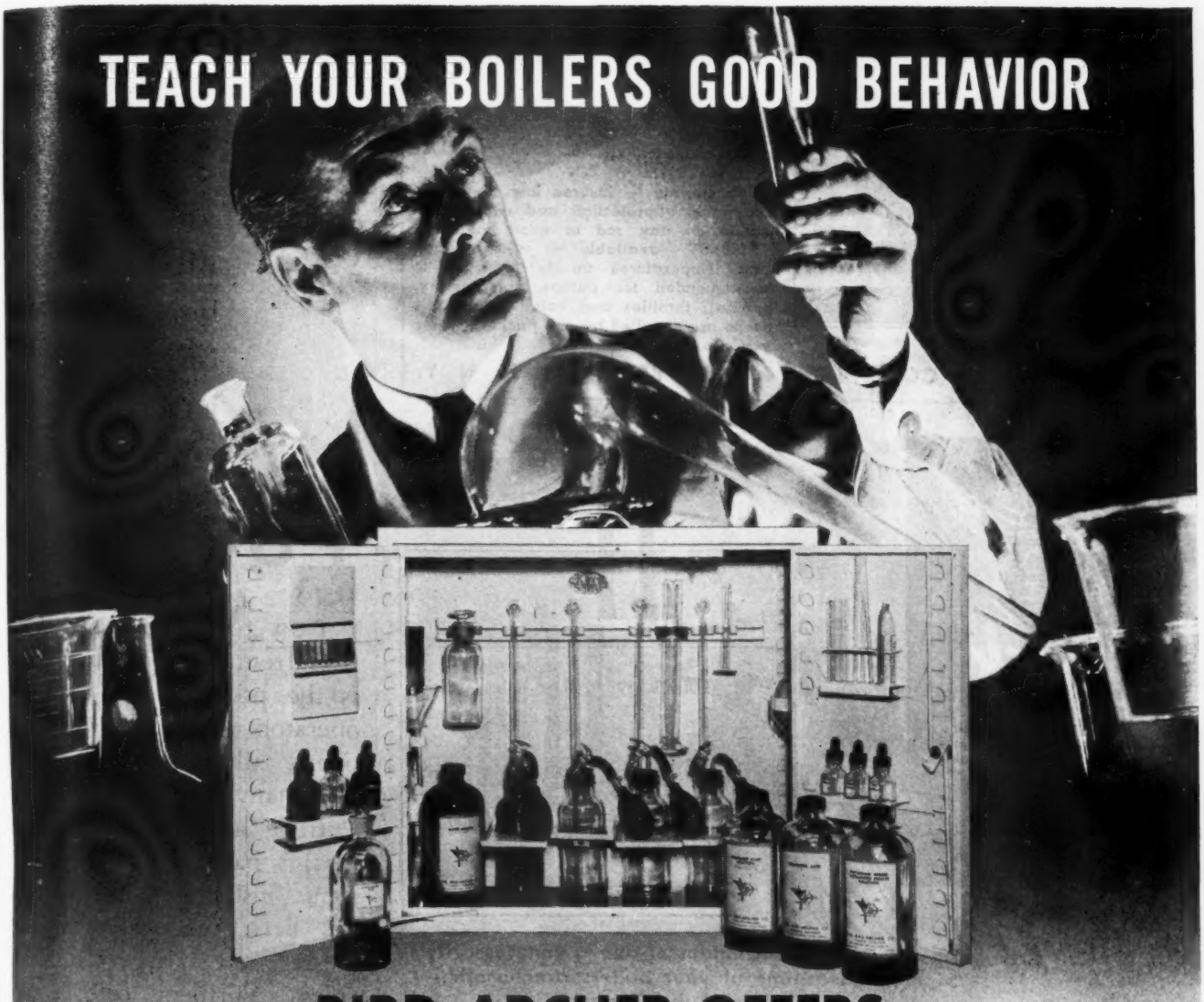
Brickseal cannot crack, blister or peel off due to sudden temperature changes because it remains semi-plastic until the furnace cools, when Brickseal becomes hard as steel. Boiler can be used immediately after Brickseal application. The glossy Brickseal surface reflects heat, prevents air infiltration, and permits increased production with less fuel. Maintenance expense due to cracking, spalling or erosion is reduced or eliminated entirely with Brickseal.

Brickseal is applied easily with brush or spray gun. Its cost is insignificant compared with the results it produces.

Write for sample or Brickseal representative.

BRICKSEAL
REFRACTORY CO.
1029 CLINTON ST., HOBOKEN, N. J.

TEACH YOUR BOILERS GOOD BEHAVIOR



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an outstanding . . . modern . . . complete service in

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Write for our latest Booklet on
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Consultation . . . without obligation

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SURVEYS • PLANT STUDIES • CONSULTATIONS • TREATMENTS
PLANT DESIGN • SUPERVISORY SERVICE • LABORATORY SERVICE

Put "AMBEST" to a long life test on any tough job

This UNIVERSAL packing — of long, pliable, anti-friction metallic alloy strands — insures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F.—is recommended for pumps, compressors, engines, throttles and valve stems. All needs are supplied by one packing when you use "AMBEST."

EUREKA

Write for Working Sample
Send for 36 page catalog

EUREKA PACKING CO., 294-296 46th St., BROOKLYN 20, N. Y.

Back on the line *in less time*

Production losses due to unnecessarily long down-time of your boilers can be eliminated—with Wilson Tube Cleaners.

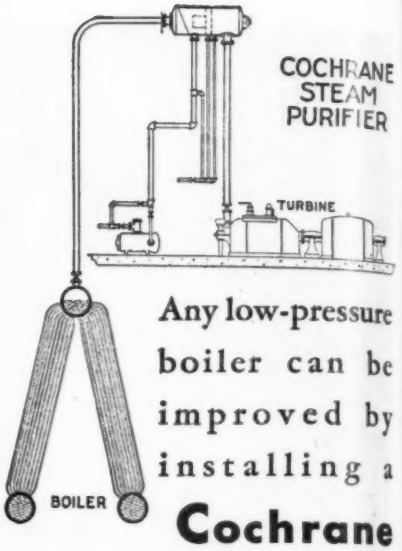
The high torque and extra power, together with the non-stalling characteristics of the Wilson E. P. and E. C. T. Series Air Motors, make possible fast, easy removal of all types of deposits in straight or curved tubes of boilers and other large bore tubular equipment. Moreover, automatic valving of the operating air, exclusive with Wilson, reduces air consumption to a minimum.

Thomas C. Wilson, Inc. maintains a large engineering staff to help you solve your tube cleaning problems. A copy of the Wilson Tube Cleaner's Check List and a 40-page bulletin describing the complete line of Wilson Tube Cleaners will be sent on request.

Wilson Tube Cleaners for straight and curved boiler tubes

wilson
PIPE AND TUBE CLEANERS EXCLUSIVELY

THOMAS C. WILSON Inc.
21-11 44th AVENUE, LONG ISLAND CITY 1, NEW YORK



Any low-pressure boiler can be improved by installing a

Cochrane PURIFIER

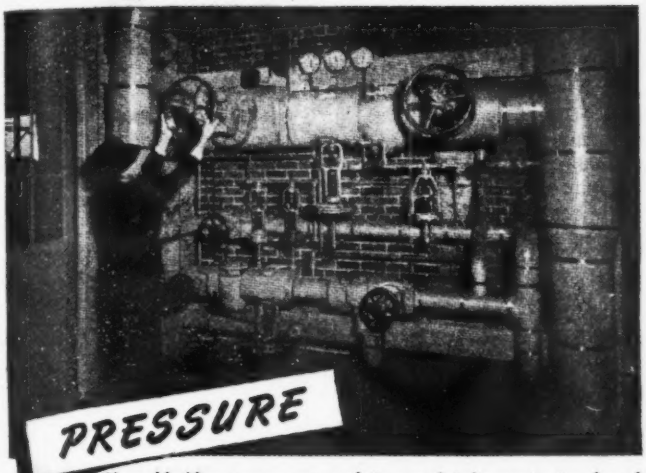
How to get greater capacity from low-pressure boilers is the problem that confronts operators in many power plants all over this country. For many years the Cochrane Purifier has been one answer to this particular problem. In some instances boiler output has been practically doubled after installing Cochrane Steam Purifiers or Receiver Separators. For example:

A large industrial plant in Indiana needed more boiler capacity quickly, but 400 h.p. was the maximum load that could be carried on the 250 h.p. boiler without danger from slugs of water. After installation the owner writes: "We are now carrying 700 h.p. on the boiler whereas before installing the Cochrane Purifier we were able to carry only 400 h.p. without carry-over."

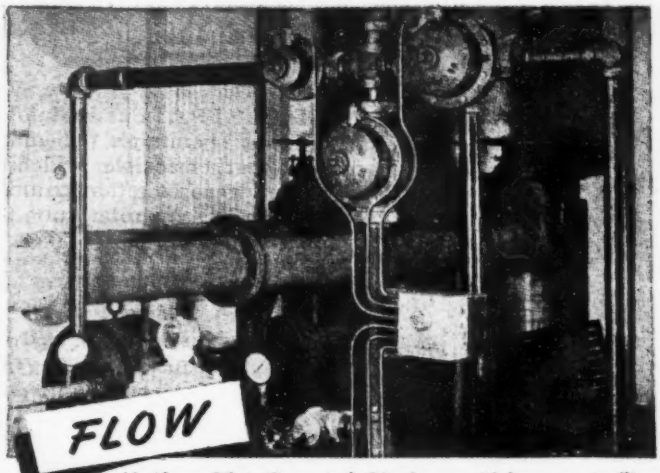
Write for a copy of Publication 2725

COCHRANE CORP., 3106 N. 17th St., Phila. 32, Pa.

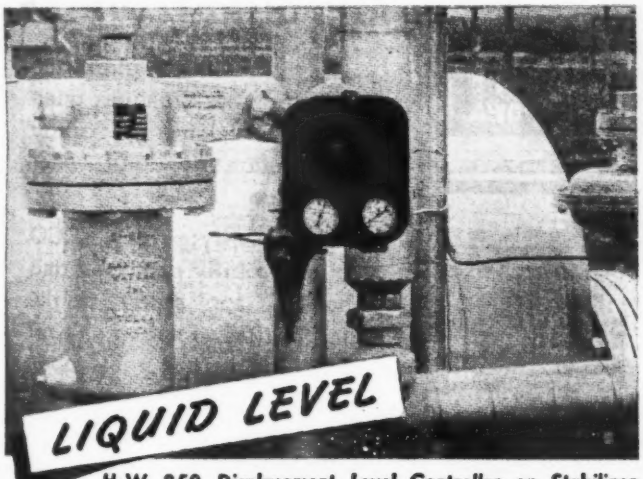
HOW INDUSTRY MEETS EXACTING REQUIREMENTS FOR CONTROL OF...



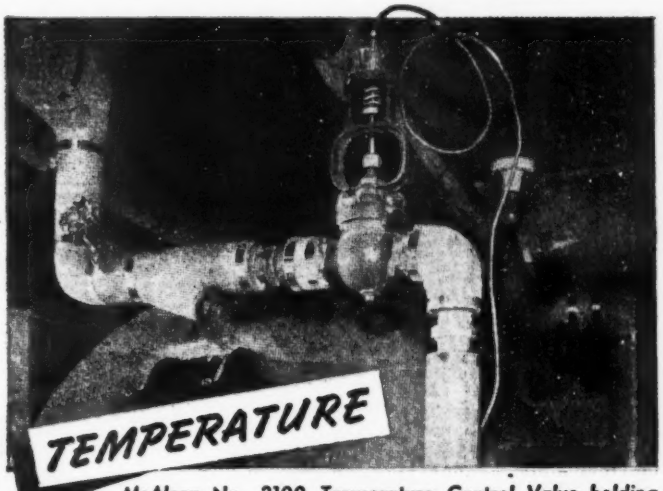
Here McAlear pressure regulators maintain constant reduced steam pressure in large Government Housing Project.



McAlear Pilot Operated Diaphragm Valves, controlling flow of hard-to-handle liquid in processing plant.



H-W 850 Displacement Level Controller on Stabilizer Reboiler. Controls liquids of any gravity, temperature or working pressure.



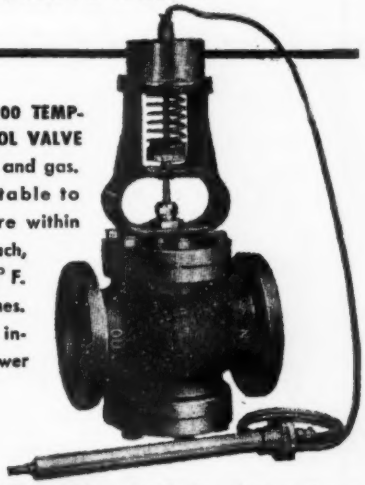
McAlear No. 3100 Temperature Control Valve holding constant temperature in feed water heater. Available in ranges of 40° each, from 75° to 260° F.

DEVELOPING high precision controls for more than 500 different, specific applications in power and process industries—over a thirty year period—has produced a McAlear precision control for almost every conceivable power or process requirement—*precision engineered*, metallurgically and mechanically, to give long, trouble-free service.

FOR EVERY APPLICATION—involving control or regulation of temperature, flow or pressure of steam, water, air, gas, chemicals or oil—McAlear either has the control instrument you need, or—will develop a special control where *unusual* conditions require it. For descriptive bulletins and catalog, write McAlear Manufacturing Company, 1913 S. Western Avenue, Chicago 8. *Affiliated with: Hanlon-Waters Company, Tulsa; Climax Engineering Company, Clinton, Ia.*

H-W
McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL—GAS
WELDED TANKS
BOLTED TANKS
SEPARATORS

McALEAR NO. 3100 TEMPERATURE CONTROL VALVE for steam, water and gas. Readily adjustable to any temperature within ranges of 40° each, from 75° to 260° F. Sizes ½ to 4 inches. Used in process industries and power plants.

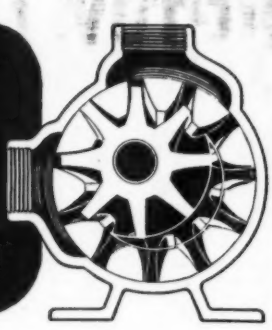


Bronze bulb and brass fittings standard—other metal combinations for special uses. Other types in sizes ½ to 8 inches.

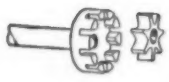
Features That Make

VIKING

THE LARGEST SELLING ROTARY PUMP IN THE WORLD



AS ILLUSTRATED above, Viking Rotary Pumps operate on the famous "gear-within-a-gear" principle, which provides a larger sealing surface that reduces slippage so prevalent in some rotary pumps after being in service for a time.



Vikings have only TWO MOVING PARTS, each of which is self-supporting. Simplicity means long life and dependable service . . . no frequent replacing of small, intricate parts to maintain pump efficiency.

Write today for Bulletin 800, which gives complete information about Viking Rotary Pumps widely used in the power equipment field. It will be sent free by return mail.

VIKING PUMPS — FIRST IN AMERICA

VIKING Pump COMPANY
CEDAR FALLS, IOWA

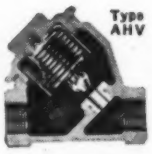
NICHOLSON

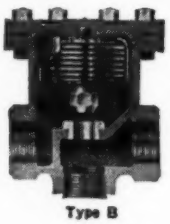
INDUSTRIAL

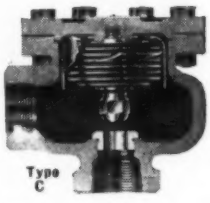
STEAM TRAPS

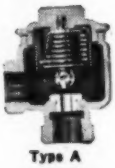
discharge air and wet steam as efficiently as water . . . with quick positive action

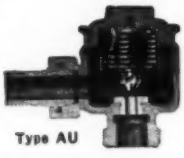
Better Circulation of Steam, More Rapid Transfer of Heat











Write for Bulletin 843 or see Sweet's

This is only one of the features that make Nicholson Industrial Steam Traps lead in their field. Consider these other advantages:

NO FREEZE-UPS—Drain completely when cold, hence cannot freeze.

NO ADJUSTMENT—Same size valve and seat for any pressure from vacuum up to the maximum allowable with construction used.

NO DRIBBLING—Closes immediately when steam contacts bellows.

NO WATER-LOGGED UNITS—Requires but a few degrees temperature differential to open valve.

***OTHER NICHOLSON PRODUCTS:** Piston and Weight-Operated Steam Traps; Compressed Air and Gasoline Traps; Flexible and Compression Shaft Couplings; Expanding Mandrels; Arbor Presses; Steam Eliminators and Separators.*

W. H. NICHOLSON & CO. 125 OREGON ST. WILKES-BARRE, PA.

EDCO

SPRAY NOZZLES

for RE-COOLING AND AIR CONDITIONING

Any industrial atomizing —cooling—or washing operations that call for spray nozzles can be done *better* with Edco.

Here's why: every EDCO tip is carefully designed and checked for spray angle, atomization and actual rated capacity — goes through rigid inspection before the EDCO diamond is stamped on it.

EDCO *is furnished in*

STAINLESS STEEL
BRONZE
NITRALLOY
MONEL
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HARD RUBBER

For savings offered by EDCO write at once for Booklet 3C1.

EDDINGTON METAL SPECIALTY CO.
P. O. Box K **Eddington, Pa.**

PENFLEX

NOW 24" I.D. PENFLEXIBLE INTERLOCKED GALVANIZED STEEL HOSE FOR STATIONARY and MARINE DIESEL EXHAUSTS

PENFLEX Interlocked construction resists pulsations of load and pressure, absorbs vibration, prevents metal fatigue. PENFLEX Interlocked construction provides the flexibility to make quick, easy installations. PENFLEX Interlocked construction with asbestos packing gives you a pressure-tight, trouble-free exhaust connection. PENFLEX 24" Interlocked, the largest hose in the PENFLEX line, has a bending radius of approximately seven times its diameter and a working pressure of 15 to 25 psi. PENFLEX Interlocked construction requires no special tools or heat to bend.

Complete range of sizes from 5/32" I.D. to 24" I.D.

PENFLEX
Hose and Tubing is also available for other flexible connections on Diesel Installations.

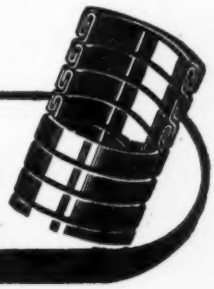
PENFLEXWELD
for Fuel Oil and Starting Air.

PENFLEX
Interlocked for Lubricating Oil, Circulating Water, Exhausts and Air Intake Lines. Write for Bulletin 71.

PENFLEX METAL HOSE

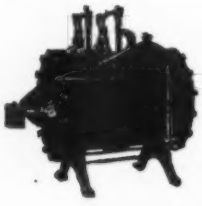
PENFLEX

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7238 POWERS LANE Established 1902 **PHILADELPHIA 42, PA.**



STERLING

BOILER FEEDING—LIFTING
PUMPING—VACUUM CREATING
VACUUM DRAINING UNITS



Rugged construction—lifetime non-corrosive metals used throughout

Pressure lubrication eliminates stuffing box leakage

NOISELESS OPERATION

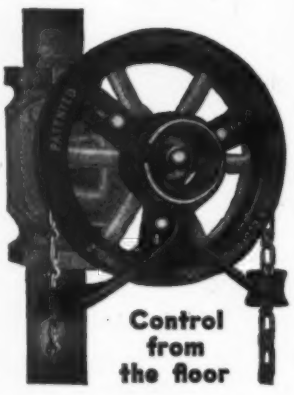
No electricity used—assured operation in spite of current failure

HEAVY WALL GAUGE GLASS

Send Us Your Problem

Sterling Engineering & Mfg. Corp.
TEMPLETON MANUFACTURING CO.
110 Business St. Hyde Park 36, Mass.

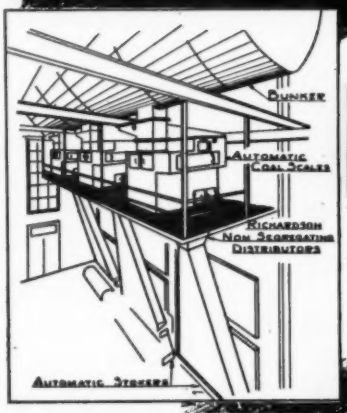
Make Your Overhead Valves SAFE And Easy to Reach---

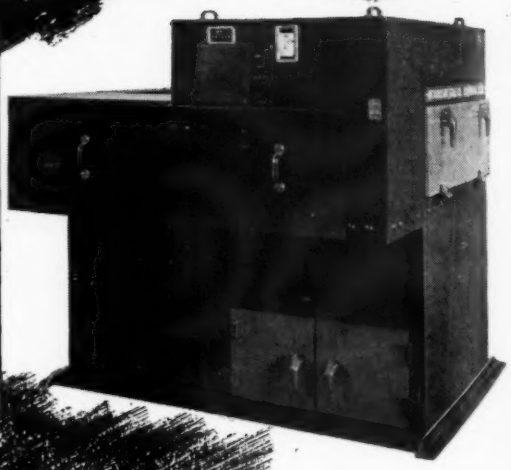


With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

One OVER EACH BOILER *Cuts* COAL WASTE





Conventional installation of Richardson Automatic Scales under bunker for weighing coal to stokers of boilers.

Spotting excess coal consumption is speedy and direct with Richardson Automatic Coal Scales. One over each boiler tells when the evaporation rate for any boiler is dropping. Guided by these exact reports, you can go into sure action on a "lame duck" boiler, correct it within a shift, within an hour. In thus maintaining maximum efficiency in all boilers, Richardson Coal Scales make for use of much less coal, save power plants thousands of dollars annually.

In addition, because Richardson Scales do not require weighmen, they release manpower for other work. Models may be equipped to draw coal from distant outlets by means of Richardson elongated conveyors. These save boiler room height, and reduce cost of building.

Complete details of construction and operation of Richardson Coal Scales, including 45 pages of data, diagrams and installation photos, are supplied in Bulletin 1143. Write for a copy.

RICHARDSON
SCALE COMPANY, CLIFTON, NEW JERSEY

Atlanta Boston Chicago Philadelphia Omaha Montreal New York
Minneapolis Detroit San Francisco Toronto Wichita Pittsburgh

Cooling Tower DOs and DON'Ts

-by MARLEY (No. 3 of a series)

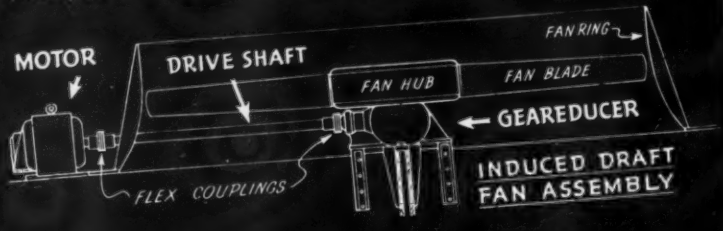
MECHANICAL MAINTENANCE

Well-kept equipment delivers the best operating results for the least overall maintenance cost.

FANS—Inspect frequently to see that blade clamps and hub bolts are tight. Fans may get out of balance, due to neglect and corrosion, and require rebalancing. Hence clean and paint all corrodible metal parts as often as necessary, depending upon the nature of the tower water and the atomosphere.

SPEED REDUCTION GEARS—Follow the manufacturer's lubrication instructions religiously. (Marley "Geareducers," although outstandingly rugged and trouble-free, nevertheless deserve and require the minimum care set forth on the name plate.) There is always slight "play" in ring and pinion gears, but if excessive, wear is indicated. Pinion shaft end play or fan shaft side play indicates excessive bearing wear. If oil leaks around either shaft, oil seals should be replaced.

DRIVE SHAFTS—Keep drive shafts in alignment and balance, all coupling bolts tight. Replace or repair universal joints or flexible couplings when worn. Lubricate these joints as necessary. (Marley's disc-type couplings require no lubrication.) Keep shaft guards securely in place.



CENTERLINE OF TOWER BENEATH FAN
DRIFT ELIMINATORS
BLADES NEAREST TO FAN SHOULD SLANT TOWARD THE FAN IN ALL TOWERS
CENTER LINE OF TOWER BENEATH FAN
CORRECT FOR FORCED DRAFT OR CONVENTIONAL INDUCED DRAFT COOLING TOWERS
CORRECT FOR "DOUBLE-FLOW" TOWERS

MOTORS—Grease ball-bearing motors with an approved water-resistant lubricant every one to three months, according to manufacturer's instructions. Do not over grease.

Once a year check insulation value with a megger, or by similar means, and paint the motor winding with approved insulation varnish and the frame with anti-rust paint.

WOOD PARTS AND FRAMEWORK—Check drift eliminators each season to see that all blades are in place and alignment. If necessary to remove any section, make sure it is replaced with blade edges slanting toward the fan as illustrated in the accompanying sketch.

Well-designed filling (the "decking" or latticework inside most larger towers) will not sag or warp appreciably but if such condition is noted, correct it. Replace broken laths.

Bolts of tower frame and casing should be tightened yearly and corrodible metal parts painted. Redwood does not require painting for weather protection.

MARLEY COOLING TOWERS

34-A

DO YOU KNOW — that the Marley Geareducer is the only speed reducer designed specifically for cooling tower service and the only such drive furnished as standard equipment. Rugged dependability under the most severe conditions. Positive, direct drive for fans from motor outside of fan ring in an accessible location out of the hot, damp air stream.

THE MARLEY COMPANY, INC. · KANSAS CITY · KANSAS

C. H. WHEELER
OF PHILADELPHIA

STEAM CONDENSERS

•

AIR EJECTORS

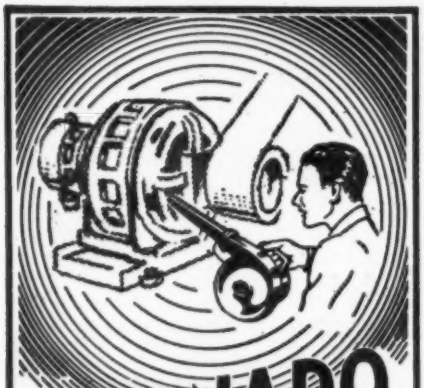
•

MECHANICAL DRAFT
COOLING TOWER

•

DECK MACHINERY

C. H. WHEELER
MANUFACTURING CO.
19th St. & Lehigh Ave.
Philadelphia 32, Pa.



TORNADO
PORTABLE
ELECTRIC BLOWER
reduces
DUST DANGER

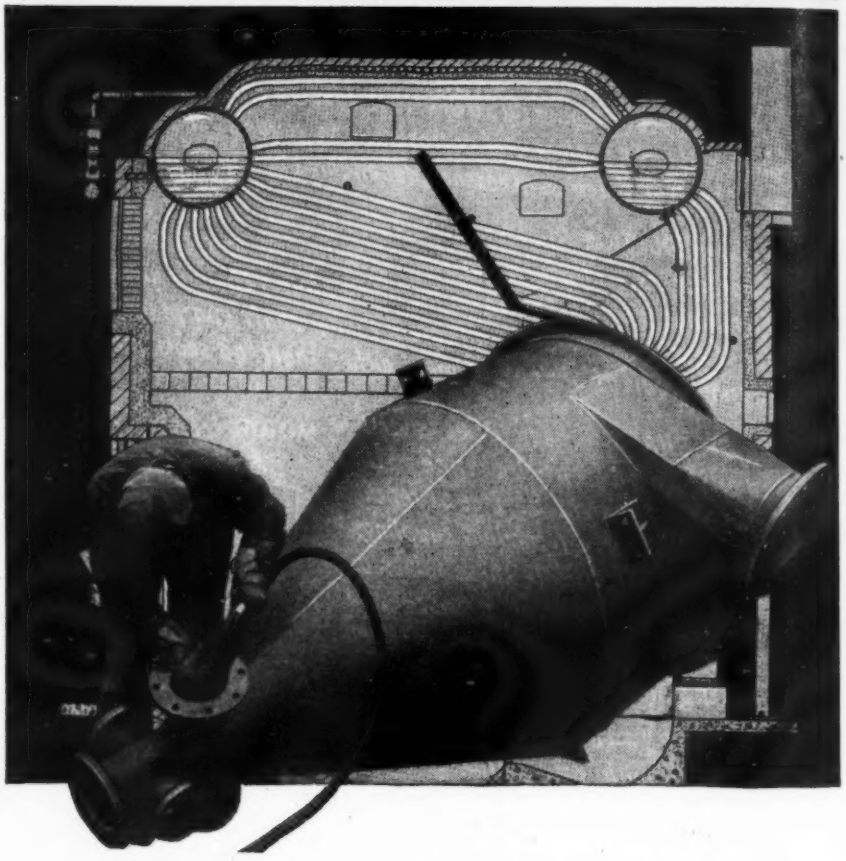
BLOWS clean, dry air, at 295 m. p. h. Cleans out motors, generators and hard-to-get-at places—removing dust, dirt, lint and chips. Costs less than 3c. an hour to operate. Reduces damage to motors and bearings—lessens fire and health hazards.

1 H. P. universal G. E. motor. Weight, 14 lbs. Portable to any place in plant. Plugs in at convenient outlets. Adaptable as Sprayer for spraying paint and insecticide. Convertible into powerful Industrial Vacuum Cleaner—for cleaning floors, walls, ceilings.

Free Trial—Write to
BREUER ELECTRIC MFG. CO.
5114 N. Ravenswood Ave., Chicago 40

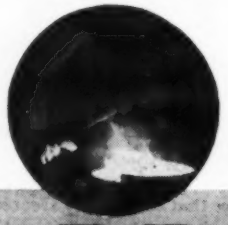
TAKE THE DUST OUT OF DUSTY WORK
TORNADO

UNION



UNION Welded Pressure Vessels and Fabricated Steel Work to specifications are speeding into vital applications in the Chemical and Process Industries. Our shops are equipped to roll heavy plate, hot or cold to 26 feet width, A. C. & D. C. and Atomic Hydrogen Welding Equipment, checked by X-Ray, Gamma Ray and Magnaflux inspection to assure highest quality welded construction.

Large, automatically controlled, stress relieving furnace capacity provides uniform temperature and slow cooling.

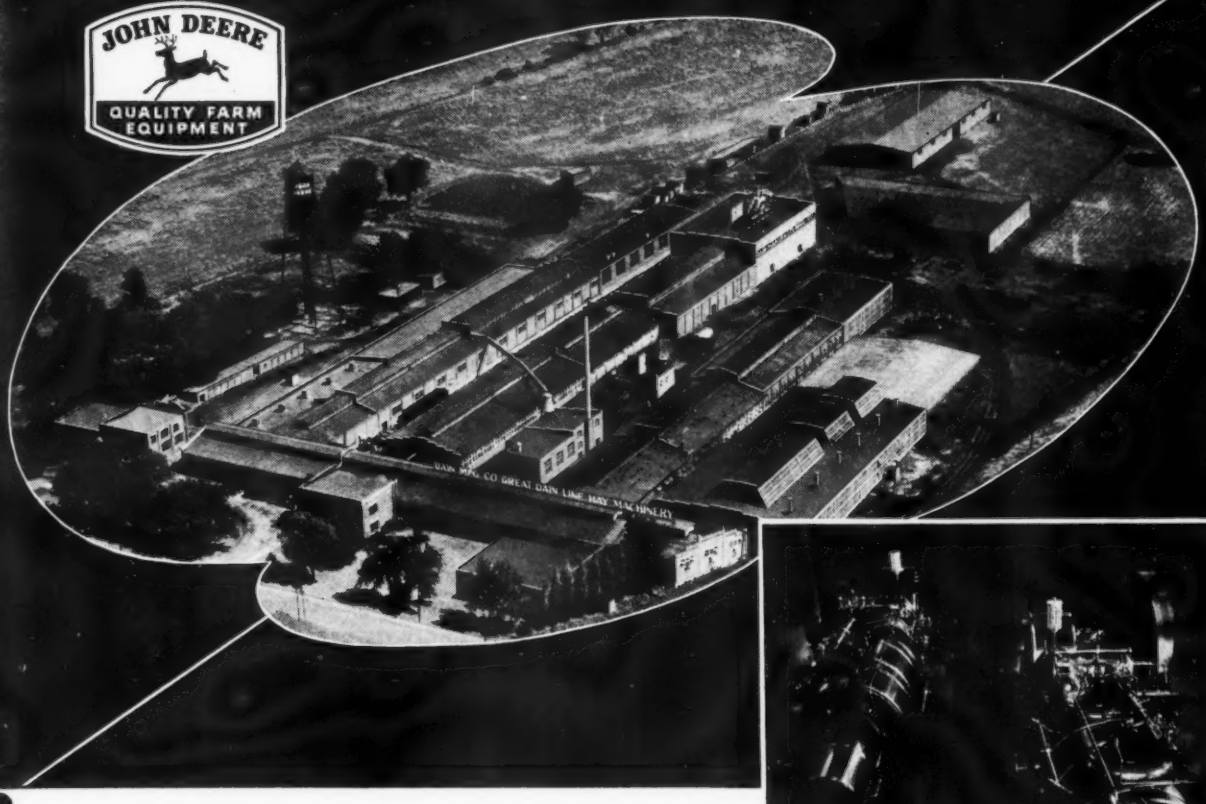


Send your pressure vessel and fabrication specifications to Union of Erie for highest quality workmanship. *Write for booklet on facilities.*

UNION IRON WORKS - - - ERIE, PA.

PRESSURE VESSELS
STEAM GENERATING EQUIPMENT

• FROM JOHN DEERE'S ANVIL GREW 14 GREAT FACTORIES



The 300-kw. and 350-kw. "Universal Unaflow" engine-generator units in the Dain Manufacturing Company plant of Deere & Company, Ottumwa, Iowa.

• SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES Generate Electric Power in 7 of These Plants

FROM Vermont in 1836 a Yankee started west, carrying with him a small bundle of tools and a much smaller bundle of cash. But John Deere also carried with him a thorough mastery of the mechanic and blacksmith trades, as well as inventive genius and breadth of vision.

In the waxy, black soil of the prairies that stuck to the old-fashioned iron plows, John Deere found his opportunity. He believed that steel was the answer — and proved it. His plow, fashioned from a broken saw blade salvaged from a neighboring sawmill, was an immediate success and became known as "John Deere's Self-Polisher."

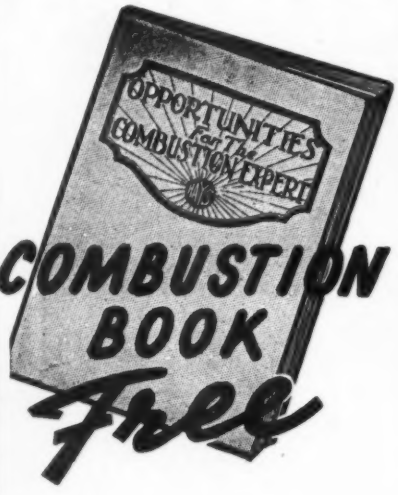
From this small beginning, over a hundred years ago, the House of Deere has been inseparably linked with agricultural equipment, such as plows, corn and cotton planters, hay machinery and scores of other items in its complete line of farm implements.

Skinner Engine Company is proud of its long and happy association with Deere & Company. Economical, dependable power is being generated in seven Deere plants by nine Skinner "Universal Unaflow" Steam Engines—with efficient use of the exhaust steam for heating and processing. This is not an unusual example, for in practically every type of industry savings are being made where far-sighted management is using Skinner engines for electric power generation. It will pay you to investigate the possibility of substantial savings in your own business. Case studies pertaining to your particular industry will be sent upon request.

Do More Than Before—Buy EXTRA War Bonds

For Over 75 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.



COMBUSTION BOOK Free

Combustion efficiency as applied to Boiler Plant Operation, Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man—the Hays trained man — can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

Just a Few of Our Hundreds of Friends

International Harvester Co....20
Armour and Co..75
Combustion Engineering Company 45
Riley Stoker Corp. 75
Iron Fireman Mfg. Co.....25
Commonwealth Edison Company 145
State of Illinois.85
Cities Service (Oil & Power) 70
and many others.

How? Through the simple, easy reading, *practical* Hays Home Study Course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time. Many companies urge their men to enroll. They know the value of Hays Combustion Training.

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The coupon below will bring you, without expense, full particulars regarding the Hays short, practical, easy reading, home study Course in Combustion. Do your part by starting now to train yourself in the uncrowded wide open field of Fuel and Combustion Engineering. Hays trained men are in demand, today more than ever. Send the coupon Now. No obligation of course.

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Please send me your Free Book "Opportunities for the Combustion Expert"—No Obligation.

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"Saturday Night" Cleanup for an OIL WELL

Yes, even oil wells need an occasional cleaning to keep up the high rate of production of crude oil needed for our all-out war effort. And to do that job, a large midwestern manufacturer developed a new method of oil well cleaning. With accuracy and dependability as prerequisites for a certain flow measuring job in this connection the manufacturer chose a

HENSZEY FLOW INDICATOR

- **Indicates flow from 0 to 100%**
- **Graduations uniformly spaced**
- **Reads direct—without constants**
- **Only 3 moving parts**
- **Installed right in pipe line**

on a trial basis.

After three months of satisfactory performance four more Henszey Flow Indicators were ordered. Two more repeat orders were sent in to bring the total up to 61 Indicators within a year.

If you need to know the rate of flow — instantly and accurately — choose Henszey Flow Indicators. Send for bulletin FI-1 for details.

Henszey Company
Dept. D2 Watertown, Wis.

HENSZEY

FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves

AN INFORMATIVE BULLETIN

ON A NEW HEAT EXCHANGER DESIGN

The bulletin illustrated on this page is the latest literature by Davis Engineering Corporation on its new *Self-Cleaning Tubular Heat Exchanger.* It explains and illustrates graphically, in color, the design and operating principle of this Paracoil Tubular Heat Exchanger.

The Self-Cleaning Heat Exchanger, however, is but one of several standard and special Paracoil Heat Exchanger designs adaptable to many heat exchange operations throughout industry. If your plant has a special heat exchange problem, we invite you to consult us.

For special heat exchange applications, engineers and operating men are referred to the bulletin shown below. Ask for Bulletin HE-100.

Paracoil

HEAT EXCHANGE EQUIPMENT

BLOWDOWN EXCHANGERS
BOILERS
exhaust gas—waste heat
CONDENSERS
CONVERTORS
COOLERS
condensate—jacket water—lubricating oil—quenching oil—solution
DISTILLING PLANTS
EVAPORATORS
EXCHANGERS
liquid to liquid—liquid to gas—solution
EXTRACTORS
grease—boiler feed water
HEATERS
instantaneous—feed water—solution — fuel oil — storage water
TRAPS
steam
VALVES
cross and three-way—exhaust gas by-pass

DAVIS ENGINEERING CORPORATION 1066 EAST GRAND ST., ELIZABETH 4, N. J.

Do your men clean the FRONT ends of tubes?

With ordinary tube cleaners, cleaning the front ends of tubes is a dangerous operation, even with perfect coordination between operator and helper. There is a natural tendency to insert the cleaner far enough inside the tube to eliminate any danger from revolving cutters when the air is turned on, thus leaving the front ends of tubes uncleaned.

With a Roto Tube Cleaner equipped with air valve directly behind the motor, the operator himself turns the air on and off. This positive one-man control permits him to turn on as much air as he needs, whenever he needs it, and he can clean right up to the end of the tube with complete safety. Get details of these time- and labor-saving tube cleaners.

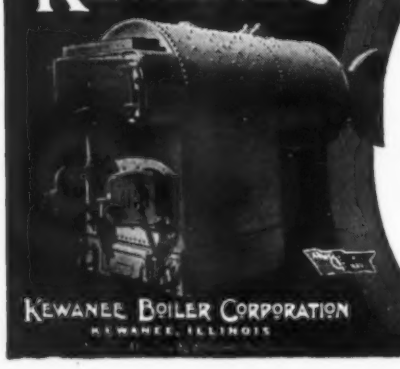
ROTO Tube Cleaners

The ROTO Company 145 Sussex Ave., Newark 1, N. J.

A Division of Elliott Company

EXTRA STRENGTH FOR HEAVY DUTY

KEWANEE



KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

Steel Plus Rivets

Steel plus Rivets further strengthened by extra stout stays and braces. Embodies all characteristics which make firebox type boilers especially adapted for high pressure.... 4 to 304 H. P. 100, 125, 150 lbs. W. P.

75 Years Boilermakers

Write Department 96-K2 for 6" scale with pipe diameter marking.

POWER HANDBOOK

56 pages (parts 1 & 2 combined), 50 cents, postpaid

This new reprinting is 6000 copies because original 3000 sold out in two months. Also you can order part 2 separately at 25 cents.

If convenient, cash with small orders will save red tape of billing. *Address all orders to POWER, 330 West 42 St., New York 18, N. Y.*

Addressed to practical power men, and written by Phil Swain, Editor of *Power*, the Power Handbook gives basic engineering data and figuring methods in simplest possible form — mostly plain arithmetic any grammar school graduate can follow. Here are chapter headings:

PART 1
(Dec. Power, 1943)

Weights & Measures
Practical Mathematics
Mathematical Tables
Mechanics & Mechanisms
Mechanics of Materials
Fundamentals of Heat
Steam Tables Simplified
Practical Electricity
Hydraulics & Pumping
Piping, Flow & Tanks
Engineering Economics

PART 2
(Feb. Power, 1944)

Feedwater Chemistry
Fuels & Combustion
Steam Generation
Turbines & Engines
Diesels, Gas Engines
Compressors & Fans
Refrigeration Facts
Heating, Air Conditioning

A NEW AND WIDER LINE OF

Heating Coils

A SIZE AND TYPE TO MEET YOUR EVERY NEED

• In recent years, great progress has been made in the design of heating and ventilating systems . . . and drying and processing equipment. Since the heart of such systems or equipment is the heat transfer surface, the demands made upon that surface have become more and more exacting. To meet them, Modine has designed a new line of lightweight blast heaters and booster units.

Twenty-eight years of building heat transfer surface . . . plus intensive wartime experience in producing thousands of coils for U. S. Navy and merchant ships . . . has improved Modine design and manufacturing technique. The result—new coils of greater durability *and* improved performance.

STEAM DISTRIBUTION TYPE BLAST HEATERS
308 types and sizes, from 3¼ sq. ft. to 17¾ sq. ft. of face area.

STANDARD BLAST HEATERS
357 types and sizes, from 3¼ sq. ft. to 29¼ sq. ft. of face area.

BOOSTER UNITS
78 types and sizes, from ½ sq. ft. to 5 sq. ft. of face area.

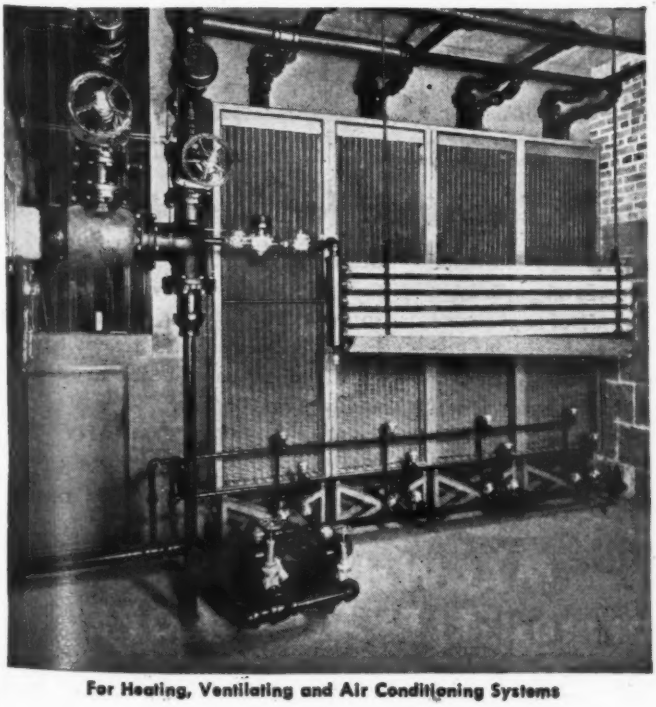
For complete engineering and application data, get New Catalog 345.

Look in your phone book for Modine representative's name—"Where to Buy It" section.

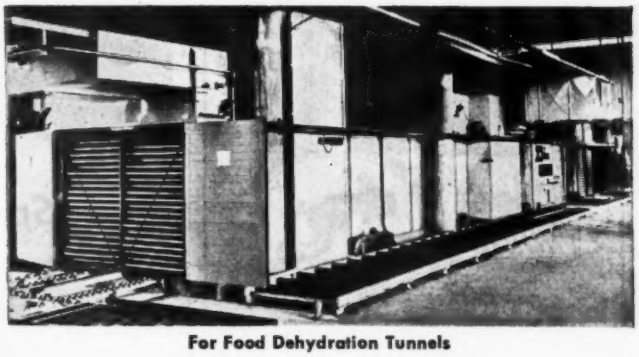
ARMY E NAVY

Modine

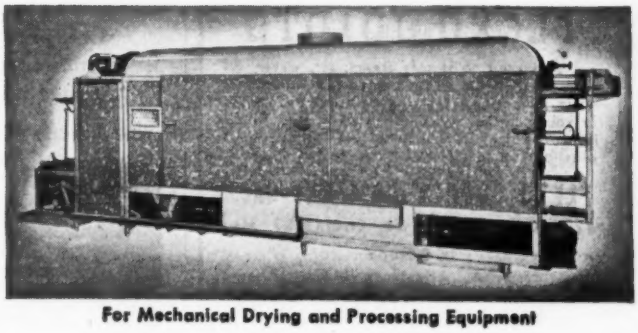
MODINE MANUFACTURING COMPANY, 1830 RACINE ST., RACINE, WISCONSIN



For Heating, Ventilating and Air Conditioning Systems



For Food Dehydration Tunnels

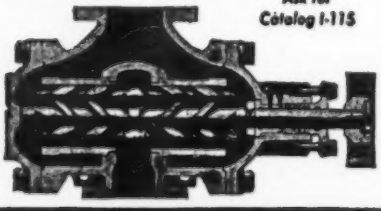


For Mechanical Drying and Processing Equipment

IMO Reliability IN NAVAL SERVICE

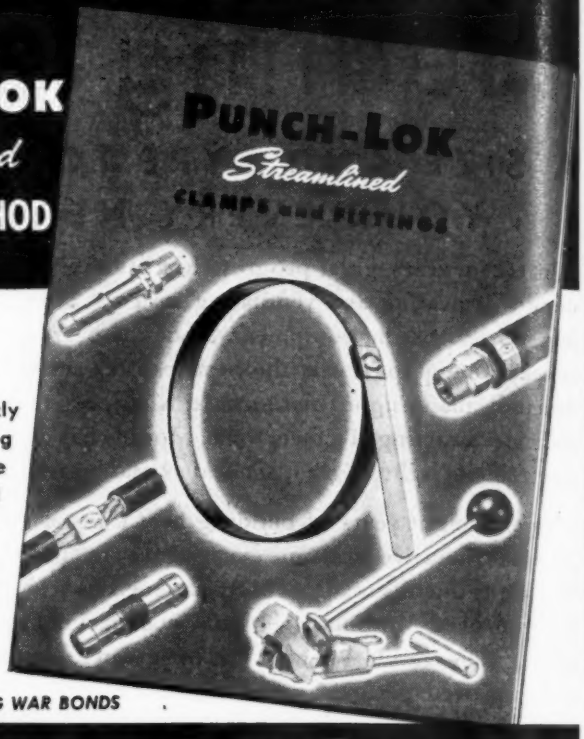
The reliability of IMO "lube" and fuel oil service pumps is typified by their trouble-free performance on a United States Destroyer reported to us by the Navy as having steamed over 84,000 miles on convoy duty during the past year, often cruising as much as 28 days per month without time for normal upkeep and overhaul.

Ask for Catalog I-115



IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton 2, New Jersey

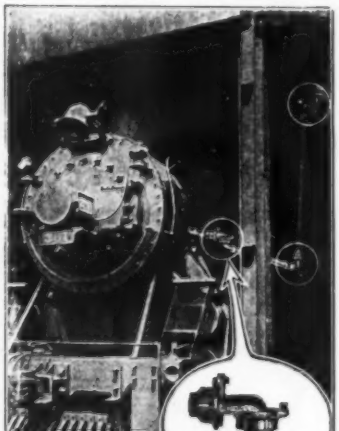
Clamp-Splice-Tie-Mend-Reinforce with PUNCH-LOK Streamlined BANDING METHOD



Punch-Lok Clamps, quickly applied with the Loking Tool, save money and time in your production and maintenance operations. Send now for descriptive catalog and name of nearest distributor.

KEEP BUYING WAR BONDS

PUNCH-LOK COMPANY
Dept. P, 321 No. Justine St., Chicago 7, Illinois



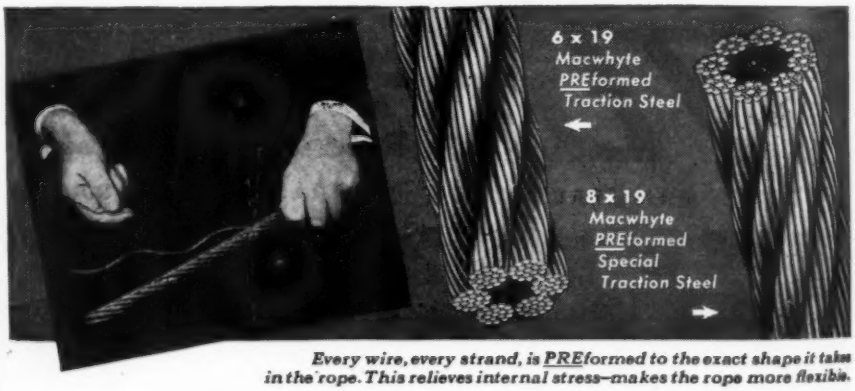
Locomotive blower line made up of pipe and FLEXO JOINTS. The flexibility of hose—the safety of pipe.

FLEXO JOINTS

are also used to supply steam, air, water, oil and other fluids to machinery or equipment while in motion. Get the details on their use in your service. Made in 4 styles and in all iron pipe sizes from ⅛ inch to 3 inches for all pressures up to 1350 lbs. superheated steam.

FLEXO SUPPLY COMPANY Inc.
4224 Olive Str. St. Louis (8) Mo.

In Canada
S. A. Armstrong Ltd.,
115 Dupont Str. Toronto (5)



Every wire, every strand, is PREformed to the exact shape it takes in the rope. This relieves internal stress—makes the rope more flexible.

Specially Designed for Elevators

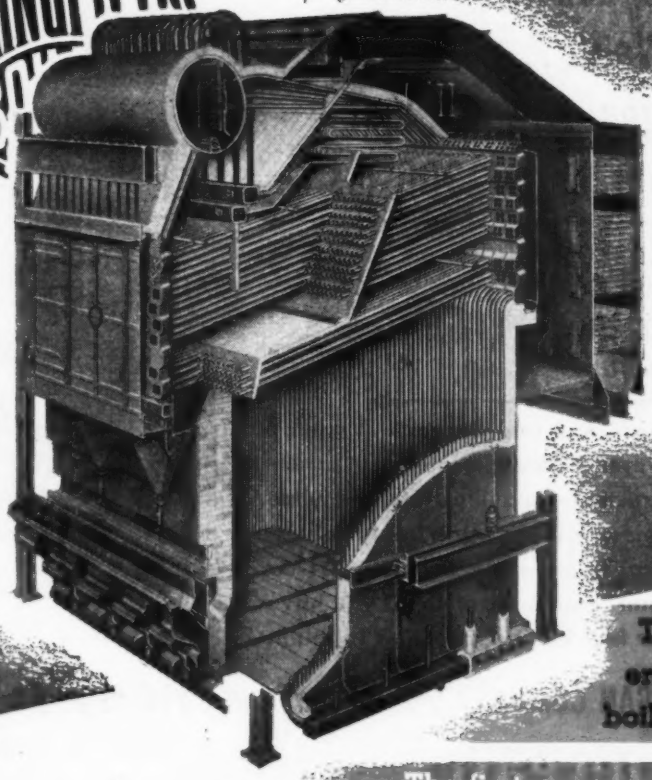
Macwhyte PREformed Elevator Ropes are made from tough, flexible wire found by years of experience to be best for elevator service. The correct lay and combination of wires are used to keep stretch at a minimum, yet make the ropes as flexible as possible to withstand bending fatigue. Flexibility is further improved by Macwhyte Internal Lubrication, which keeps individual wires and strands free to move as they bend around sheaves and drums.

MACWHYTE COMPANY
2944 Fourteenth Ave., Kenosha, Wisconsin

Specify Macwhyte PREformed Elevator Ropes to your maintenance man

NO. 787-E

MACWHYTE
PREformed ELEVATOR ROPES
The CORRECT Ropes for your Equipment



SPRINGFIELD *Developments*

That Led to the Present Original and Modern Springfield Water Tube Boiler

The first continuous "high rating" operation was produced on Springfield boilers!

The first commercially successful water wall installation in America was made by Springfield!

The close spaced water wall was developed and first installed by Springfield!

The center wall divided furnace was developed and first successfully used by Springfield!

The staggered group tube arrangement was developed and its use extended by Springfield!

The production of better boiler headers by use of cast steel has been pioneered and developed by Springfield!

The first and only cast steel mud drum was developed by Springfield!

The modern application of cast electric steel headers for marine boilers has been developed exclusively by Springfield!

It stands to reason that it is wise buying to investigate the products of a company that has so consistently pioneered sound developments which have brought big advantages to boiler users.

We have no hesitation in saying "Compare a Springfield" point for point with any boiler. Write today.

SPRINGFIELD BOILER COMPANY
1953 E. Capitol Avenue
Springfield, Illinois

SPRINGFIELD BOILERS

SPRINGFIELD

STEAM GENERATING UNITS
ANY SIZE—ANY FUEL—ANY PRESSURE

The

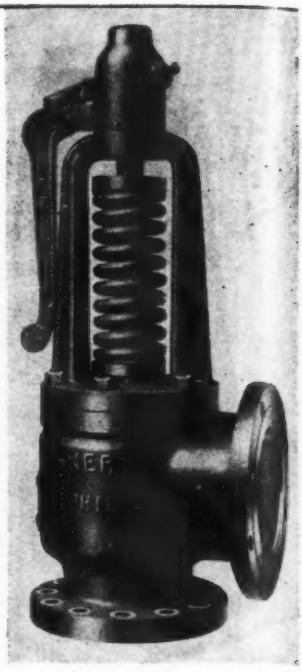
COFFIN-Steam Turbine CENTRIFUGAL PUMPS

For Boiler Feed and general high pressure service

See previous issue for details

THE J. S. COFFIN, JR., CO.
ENGLEWOOD, N. J.

This BIG Lonergan Safety Valve... discharges 178,800 lbs. Steam per hr. at 300 p.s.i.



This Little Fellow... discharges 605 lbs. per hr. at the *same pressure*

½" ODP

BOTH are efficient and dependable—represent fine engineering and construction—and illustrate the wide range of selection in Lonergan Safety Valves.

Write for Information Bulletin 501-A. Let us submit recommendations if you have a particular inquiry or application in mind.

6" x 8" V-319

J. E. LONERGAN COMPANY, 2nd & Race Street, Philadelphia 6, Pa.

Lonergan

SAFETY VALVES • PRESSURE GAUGES RELIEF VALVES • SPECIALTIES

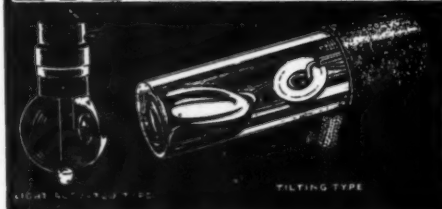
SINCE 1872 — *Makers of Pressure-Safety Appliances for the Power, Mechanical and Process Industries*

Your Up-to-date

HANDBOOK of the Latest in Power-field Practice

USE EVERY ISSUE

MERCOID



TILTING TYPE

The Only 100% Mercury Switch Equipped Controls

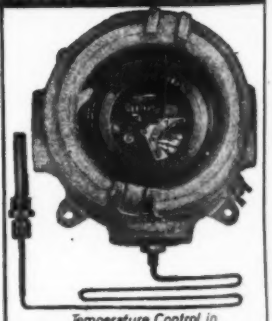
MAGNET TYPE

FOR HEATING, AIR CONDITIONING, REFRIGERATION, AND VARIOUS INDUSTRIAL APPLICATIONS

Pressure Control

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, fluid level or mechanical movement.

Mercoid Controls have many desirable features which have made them favorites among leading industrial engineers.



Temperature Control in Explosion-proof case

DA (Double Adjustment) Temperature or Pressure Controls are used extensively on industrial applications. The outside double adjustment facilitates the control operating range setting. The calibrated dial plainly indicates the desired setting. All guesswork is eliminated. No cover to open or remove when making control adjustments. A locking device is provided to prevent tampering. Various ranges available.

The hermetically sealed mercury switches are dust and corrosion-proof. There is no open arcing, pitting or sticking of contacts. These switches assure better control performance and longer control life.

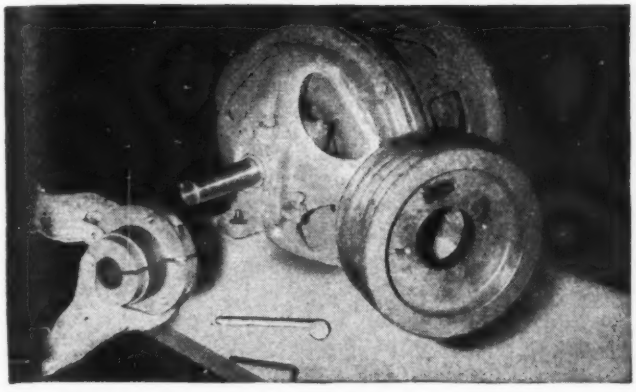
If you have a pressure or temperature control problem Mercoid engineers will assist you.

See catalog No. 600 for complete information on all types of Mercoid Controls.

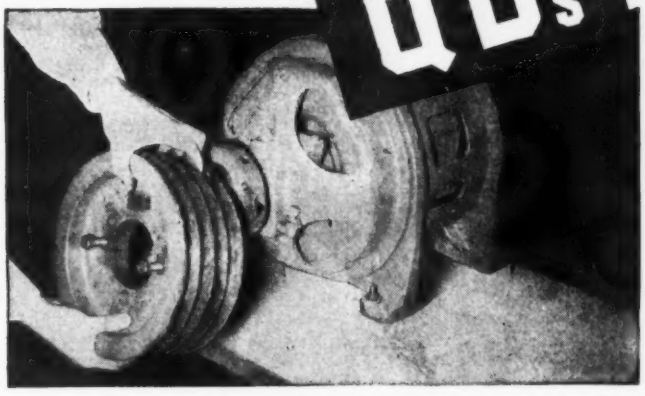
THE MERCOID CORPORATION, 4205 W. BELMONT AVE., CHICAGO 41, ILL.

DO YOU HAVE THESE 3 FEATURES IN YOUR PRESENT SHEAVES?

If so, they must be WORTHINGTON'S **QDs**



1. EASY TO GET ON



2. EASY TO GET OFF

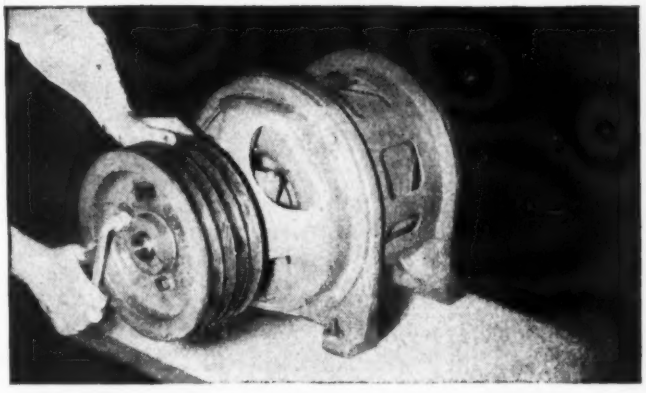
Are you losing time with old-fashioned sheaves? You may be, if you haven't got the QD's time-saving *three* features.

1. Split hub — with taper cone surface for mounting taper bored rim — makes *installation easy*.

2. Pull-up screws usable as jack bolts break Taper Friction Fit, quickly free shaft for bearing maintenance, speed changes, or *quick removal* and mounting of different diameter rims . . . without disturbing the hub. No alignment problems.

3. Bigger pull-up bolts for higher taper cone pressure insure positive clamp grip, keep sheave *always tight on the shaft*.

The sheave with these 3 features, teamed up with Worthington Goodyear Endless Cord V-Belts will give you more for your money. Stock size sheaves and belts at strategic centers from coast to coast.



3. YET ALWAYS TIGHT ON THE SHAFT

Reading Time: 3 Minutes—To Get Accurate Belt Ratings

From the 72-page Master Manual, containing original engineering data . . . sectionalized, loose-leaf, tabbed for ready reference . . . you can select in three minutes the right Worthington V-Belt drive. You get accurate belt ratings . . . avoiding *over*-belting and *under*-belting. Send the coupon today for your free copy! Specification and installation record sheets included.

Centrifugal, Rotary, Steam & Power Pumps | Vertical & Horizontal Compressors | Liquid Meters | Variable Speed Drives | Multi-V-Drives

WORTHINGTON *BEHIND THE NAME*

Standard Products Division
Worthington Pump and Machinery Corporation
Harrison, N. J.

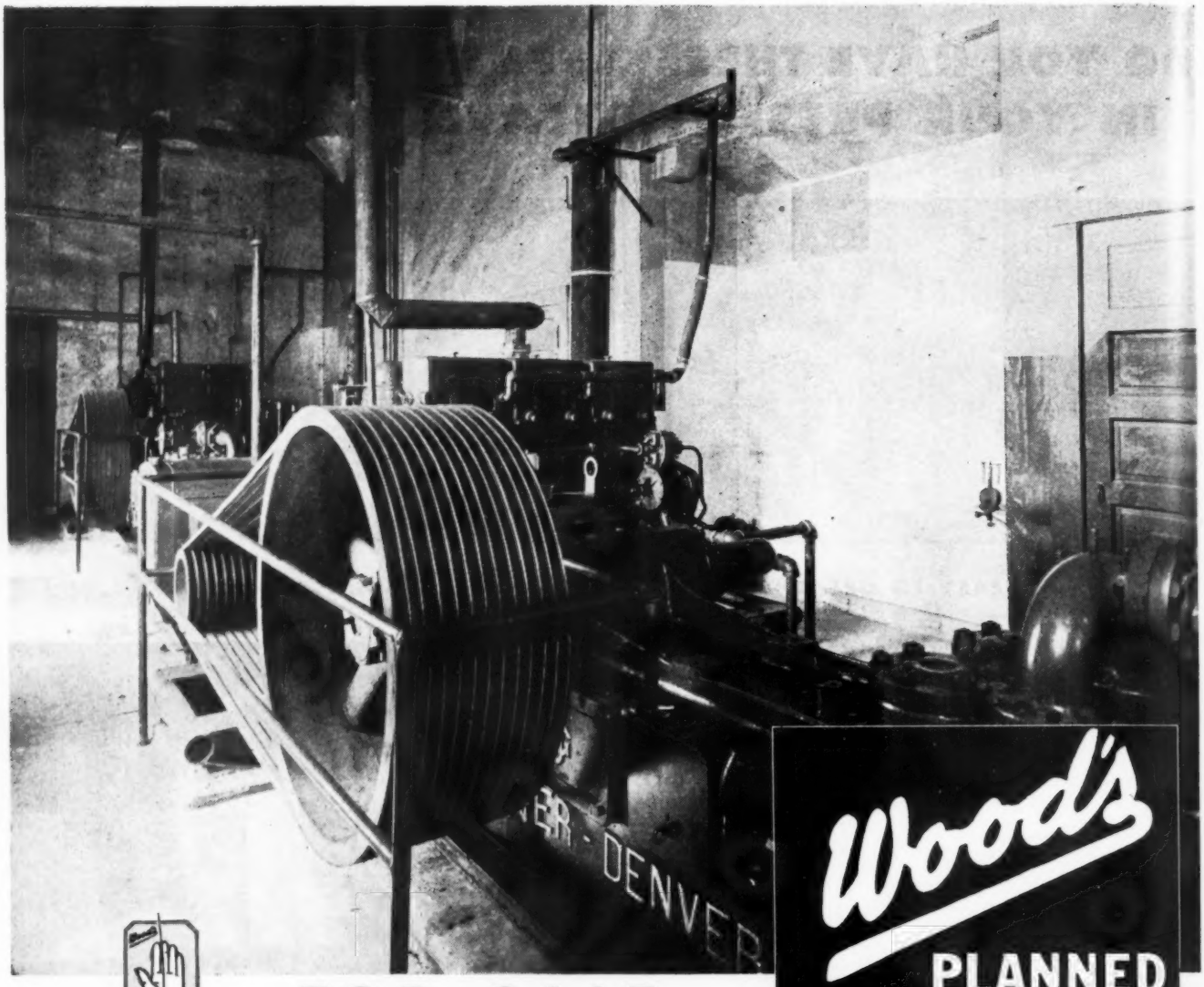
Standard Products Division
Worthington Pump and Machinery Corporation
Harrison, N. J.

Please send me a copy of the Worthington Master Manual.

Name .....

Company .....

Address .....



FOR SALE
...RESULTS

Good appearance may make a sale, but it takes inherent quality and reliable performance to *keep a thing sold.*

For 88 years Wood's have served American industry faithfully and well. Today the *results* of our pioneering experience are available to you in dependable, efficient, power transmission equipment, which delivers the highest satisfaction and lowers operating costs.

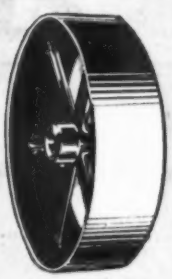
Specify Wood's planned power transmission for direct drives, modern group drives or V-Belt drives in *your* plant.

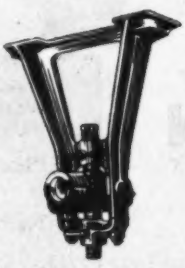
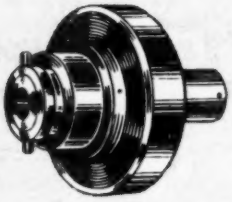
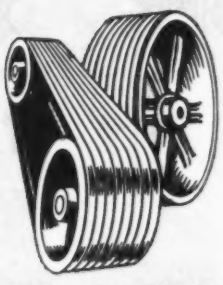
Write to us or see your local Wood's dealer for detailed information . . . No obligation.

Wood's

PLANNED POWER TRANSMISSION

The Wood's line of equipment for power transmission comprises bearings, collars, couplings, friction clutches, hangers, pillow blocks, pulleys and shafting for a variety of uses covering various industries, including cement mills, generators; paper mill, wood working and laundry machinery; compressors, mine fans, drill presses and for many other uses.



T. B. WOOD'S SONS COMPANY, CHAMBERSBURG, PENNA.

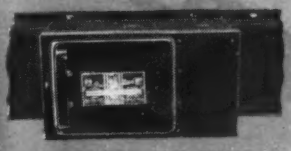
BRANCHES: 387-391 ATLANTIC AVE., BOSTON, MASS. • 83 PLANE ST., NEWARK, N. J. • 425 FIRST AVE., PITTSBURGH, PA.

With BULLDOG BUStribution DUCT

you can get increased capacity, flexibility, completeness, through this wide variety of Circuit Protective Plugs

VACU-BREAK SWITCH PLUG

Fusible and non-fusible, 30 to 600 amp., 2 or 3 pole, 575 volts or less, or 4 pole solid neutral 230 volts A.C. H.P. rated.



TYPE "PB" BUS PLUG

Cover operating types, in 30, 60 or 100 amp. Horsepower rated. Fusible and non-fusible, 575 volts or less.

CIRCUIT BREAKER PLUG

For use where an automatic protective device is required, with either rigid or flexible conduit — max. capacity, 600 amp., 600 volts.

CIRCUIT MASTER PLUG

Designed for single pole circuits for 120 volts and 2 pole for 208 volts, 15 to 50 amp.

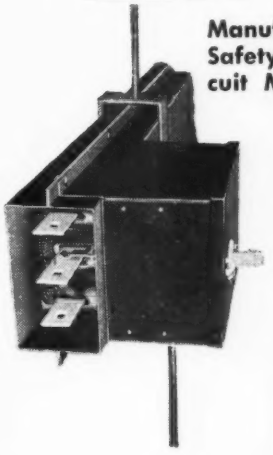
The wide variety of pre-fabricated circuit protective tap-off plugs available for use with BUStribution DUCT is just another example of the thoroughness of BullDog engineering.

Built for every circuit protective purpose, BullDog Standard Bus Plugs give you both increased capacity and complete flexibility for rearrangement of production machinery. Additional outlets can be installed quickly and inexpensively—change-overs can be made in minimum time, with minimum labor cost and no material loss.

All Bus Plugs fasten securely to the flanges of the duct section at the plug-in openings, may be mounted on either or both sides of the duct and require no auxiliary screw clamps or fittings. Engagement with the bus bars is made through spring reinforced contact fingers so designed that accidental contact with live parts is impossible.

For complete information on the various BullDog Bus Plugs illustrated in this advertisement, write for our illustrated bulletin 427-2.

Manufacturers of a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Breakers and BUStribution SYSTEMS.



MOUNTED PLUG

This end view of a plug mounted on duct shows how the copper "contact" fingers of the plug clamp over the bus bars in the duct.

Speed Victory — Buy More War Bonds!

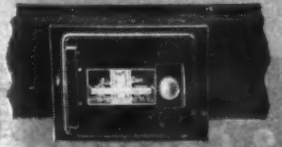
BULLDOG

ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN

BullDog Electric Products of Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities



TEMPERATURE INDICATING PLUG

When temperature of bus bar exceeds 100° C. (212° F.) (38° C. ambient plus 70° C. rise), lamp automatically lights.

CAPACITOR PLUG

Convenient and flexible means for improving Power Factor. Available from 1 to 15 K.V.A., 220 or 440 volts, 60 cycle A.C.

GROUND DETECTOR PLUG

7½ watt externally mounted Mazda lamps provide visual indication for locating grounds on system.

❶ Core is made of high grade electrical sheet steel laminations insulated to insure minimum core loss.

❷ Coils are form wound, and thoroughly insulated before being placed in the slots. Coils are securely held in slots by fibre wedges and the ends securely braced to prevent movement.

❸ Frame constructed of welded steel with heavy cross ribs to rigidly support core laminations. Stator is well ventilated, the solid coil shields directing flow of air over coils and exhausted in frame openings.

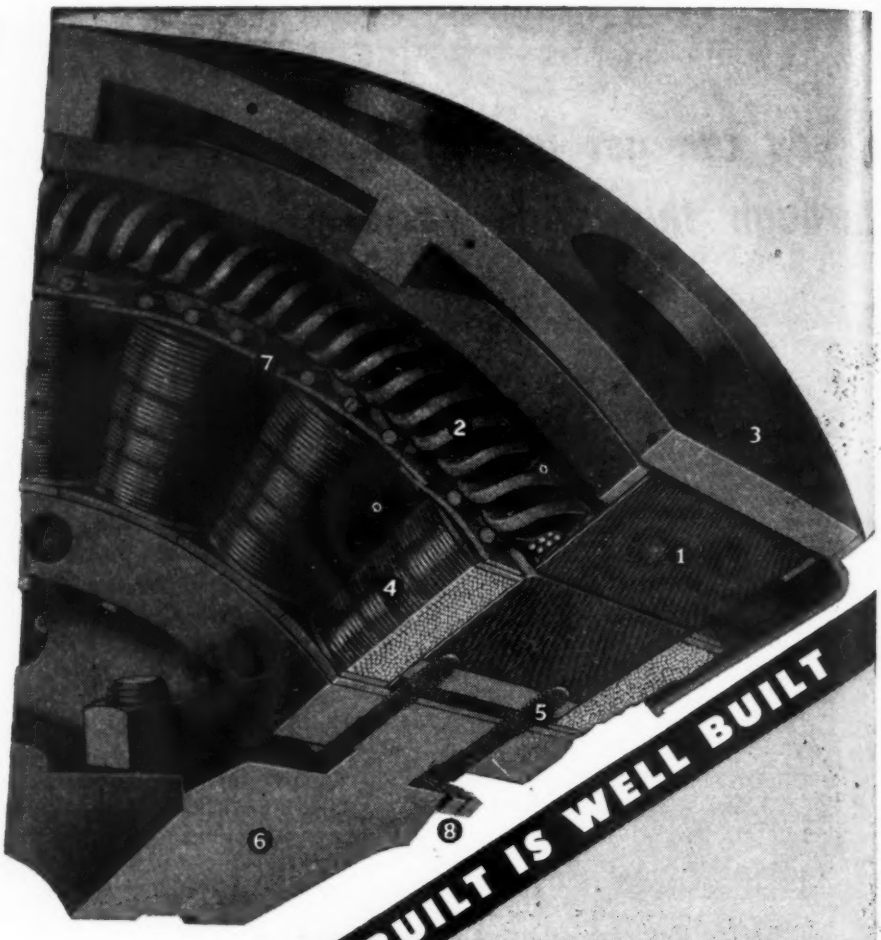
❹ Field Coils form wound, thoroughly dipped and baked. Coils are well insulated from poles, and fitted fibre washers hold them permanently tight.

❺ Each Pole Assembly is securely fastened to the Rotor by 2 large studs thru rim and anchored in large rectangular steel rivet insert which serves to hold laminations firmly together.

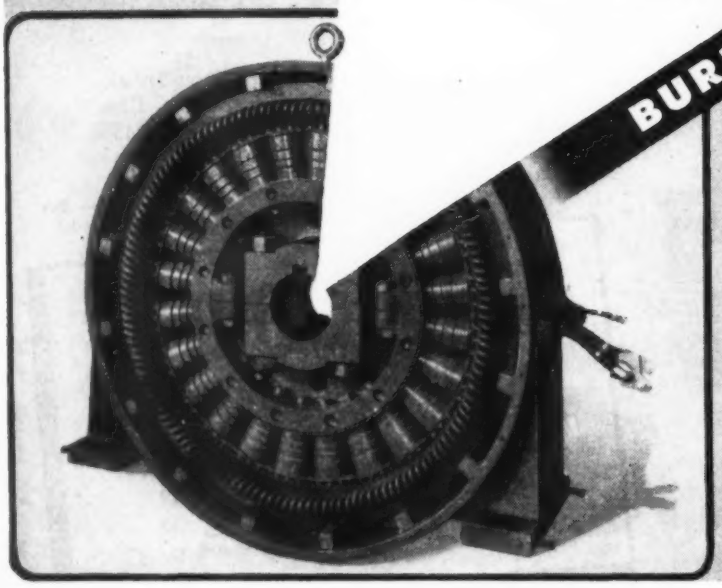
❻ Rotors are of heavy all steel construction. Rotor made with solid hub, split hub, or can be completely split.

❼ Starting winding embedded in pole face and brazed to end rings which are riveted between poles.

❽ Collector Rings are of bronze with good wearing and conductive properties.



BURKE BUILT IS WELL BUILT



BURKE

SYNCHRONOUS MOTORS AND GENERATORS

TYPICAL of the construction of the larger Burke Synchronous Motors and Generators is that detailed here. Burke as one of the oldest builders of Synchronous equipment, has stressed quality in every detail for over fifty-four years. These motors are built to meet your specifications and are available in all sizes from 1 to 1500 h. p. in belted, direct or engine types either sleeve or ball bearing equipped and with Exciter on top or direct connected. Burke engineers are ready to meet your war demands or to help you prepare for the post war period.

Write today for specific data.

BURKE ELECTRIC COMPANY • ERIE, PA.

SYNCHRONOUS MOTORS AND GENERATORS | INDUCTION MOTORS | D. C. MOTORS | D. C. GENERATORS | M. G. SETS | HIGH SPEED A. C. GENERATORS

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

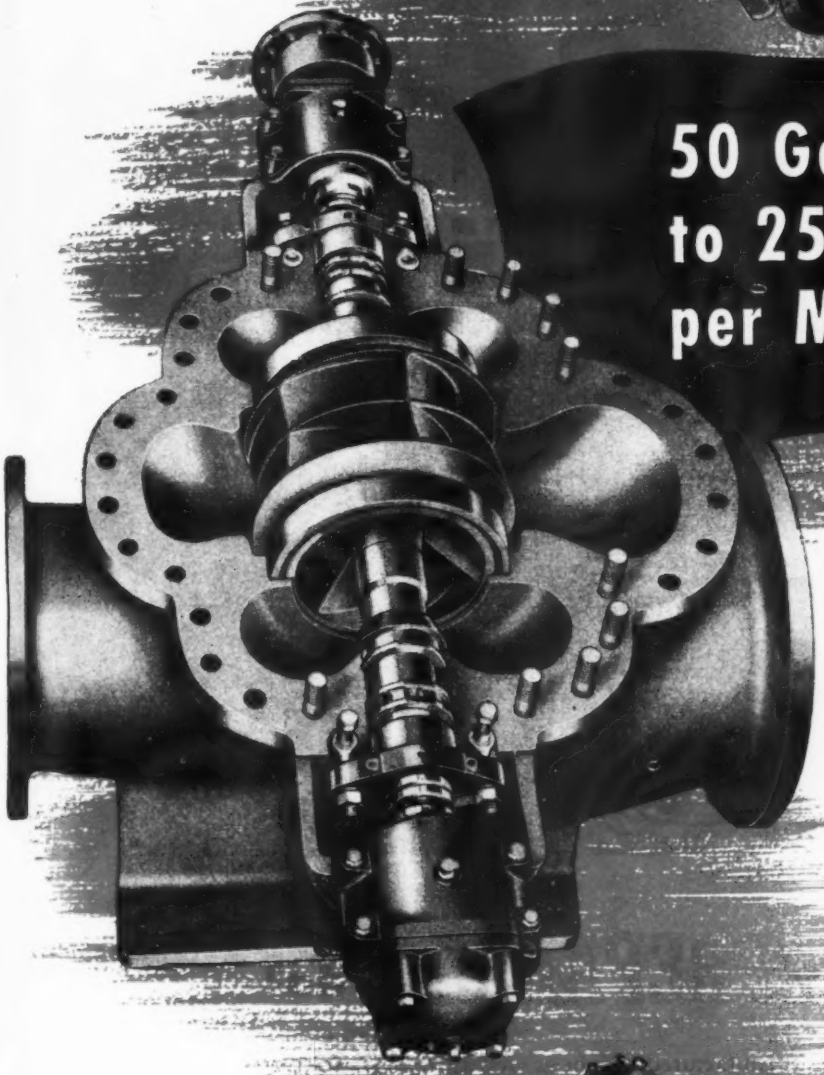
BURKE A. C. & D. C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*

PACIFIC GENERAL SERVICE PUMPS

WORTH LOOKING INTO!

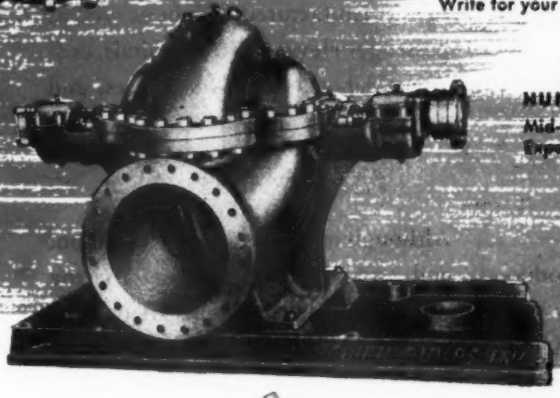
50 Gallons to 25,000 Gallons per Minute!



Featuring split-hair precision construction and meeting most rigid specifications, Pacific Type D General Service Centrifugal Pumps have proven themselves efficient, dependable and economical far beyond usual expectations.

Recommended for use in Cooling Towers, Booster Stations, Municipal Water Works, Irrigation, etc. Sizes 2" to 24", speeds to 1800 R.P.M., capacities 50 G.P.M. to 25,000 G.P.M., differential pressures to 150 P.S.I. Double suction impeller, horizontally split volute type case and many other outstanding features for which Pacific pumps have become internationally recognized.

Catalog No. 80 contains full specifications and engineering data on Pacific's complete line of precision-built pumps, designed to meet every pumping requirement. Write for your copy—or, better yet, contact . . .



Above view shows how easily complete impeller and rotating assembly may be removed from Pacific Type D pumps after top half of case has been lifted—without disturbing suction or discharge lines. Right—Same pump ready for service and many years top performance.

PACIFIC PUMPS, INC.
HUNTINGTON PARK, CALIFORNIA
Mid-Continent Division . Tulsa, Oklahoma
Export Office, 30 Rockefeller Plaza, New York
One of the Dresser Industries

PACIFIC *Engineered* PUMPS

WHAT HAS OTIS ELEVATOR COMPANY BEEN DOING?

...and what are they PREPARED to do?

The factories of the Otis Elevator Company have been devoted one hundred per cent to the war effort. That's not unique. That's the pattern of American industry.

however...

In addition to our large scale production of a great variety of highly precise mechanisms of war for the Army, Navy, and the Air Corps, we have continued to produce elevators. We have manufactured freight as well as passenger elevators for hospitals, ordnance depots, naval warehouses, and other priority installations.

this means...

Although our facilities, organization, and resources have enlisted for the duration and have gone all out for war production *as a matter of actual fact we have never been out of the business of manufacturing, installing, and servicing elevators.*

and so...

As our war work is reduced or terminated, this company is prepared – with no change in pace, and without missing a stride – to resume furnishing the highest quality elevators and escalators for all peacetime purposes.

Otis ELEVATOR COMPANY

OFFICES IN ALL PRINCIPAL CITIES

LINK CONSTRUCTION
UPS PRODUCTION

WHY Production Goes *UP* When Veelos Goes *ON*

1. You uncouple any length of belt you need from an economical stock roll of Veelos in less than 60 seconds. In another minute, it can be coupled endless and installed on the drive. *Veelos is adjustable to any length . . . adaptable to any drive!*

2. With a roll of Veelos, V-belts can be replaced in a few minutes. Machine downtime is drastically reduced. *Veelos maintains machine production!*

3. Veelos link construction provides quick, easy tension adjustment. This permits machinery to run at full speed and productivity. *Veelos ends belt slippage!*

4. On a multiple Veelos drive, all belts work together because each belt on the drive is adjusted to correct, uniform length to carry its exact share of the load. *Veelos delivers full power!*

Simple as Buttoning a Shirt

Get the "hang" of it, and you'll couple and uncouple Veelos as easily as you button your shirt. This unique, link construction is the big reason why *production goes up when Veelos goes on.* Write today for catalog telling the whole Veelos story.

MANHEIM MANUFACTURING & BELTING CO. MANHEIM, PA.

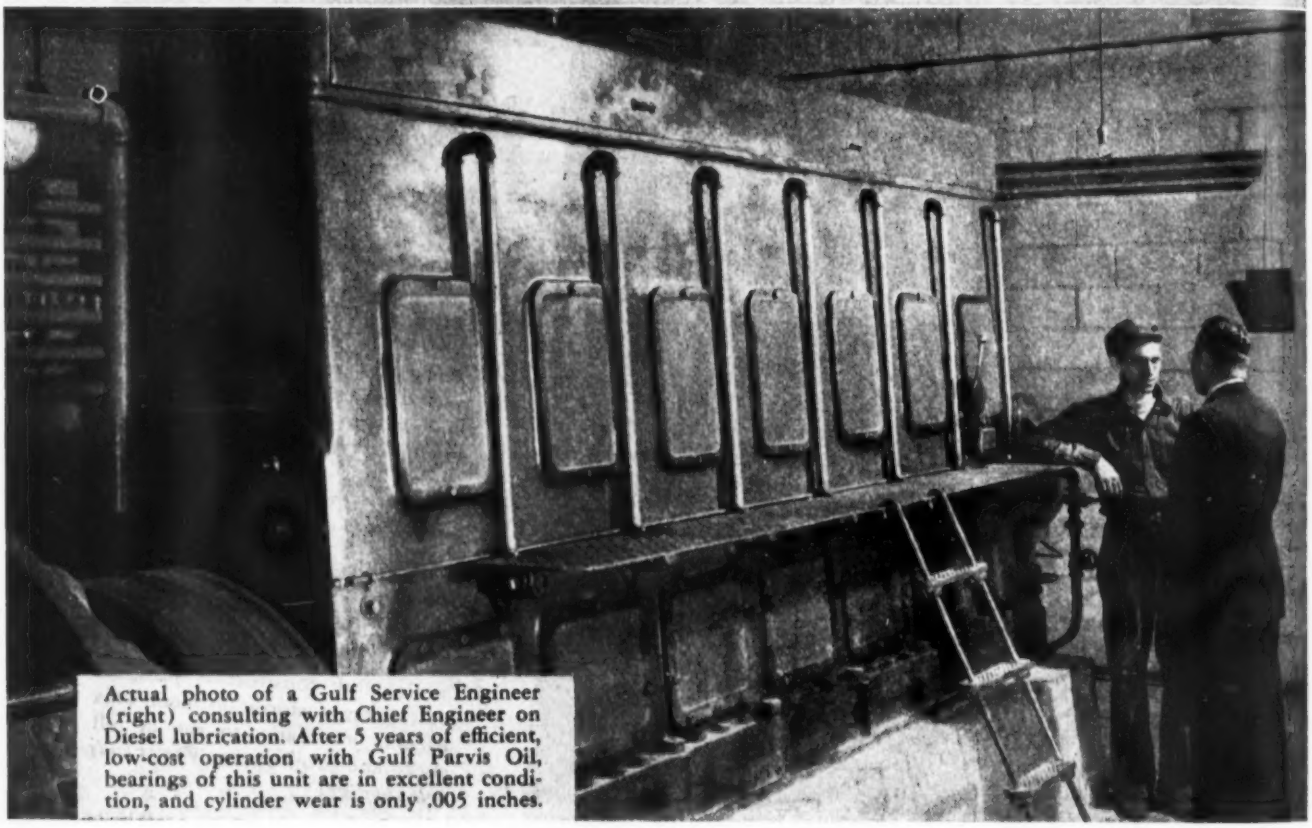
VEELOS
THE LINK
V-BELT

Adjustable to any Length
Adaptable to any Drive

Sets the Pace

in the war on Diesel Maintenance Costs—

GULF PARVIS OIL



Actual photo of a Gulf Service Engineer (right) consulting with Chief Engineer on Diesel lubrication. After 5 years of efficient, low-cost operation with Gulf Parvis Oil, bearings of this unit are in excellent condition, and cylinder wear is only .005 inches.

FOR over 15 years Gulf Parvis Oil has been a leader in the fight against wear in Diesel engines. Ask users why they prefer Gulf Parvis Oil, and their answer is something like this: "It stands up and helps keep our maintenance costs down."

Superior lubricating and staying qualities of Gulf Parvis Oil are particularly important today —when outage is figured in the loss of vitally needed kw-hrs, as well as dollars. Gulf Parvis Oil is helping many Diesel operators get more efficient and more dependable performance from their units.

If you are not one of the hundreds of enthusiastic users of Gulf Parvis Oil, it will pay you to investigate—call in a Gulf Lubrication Service Engineer and ask him to recommend the proper grade to fit your particular requirements. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company

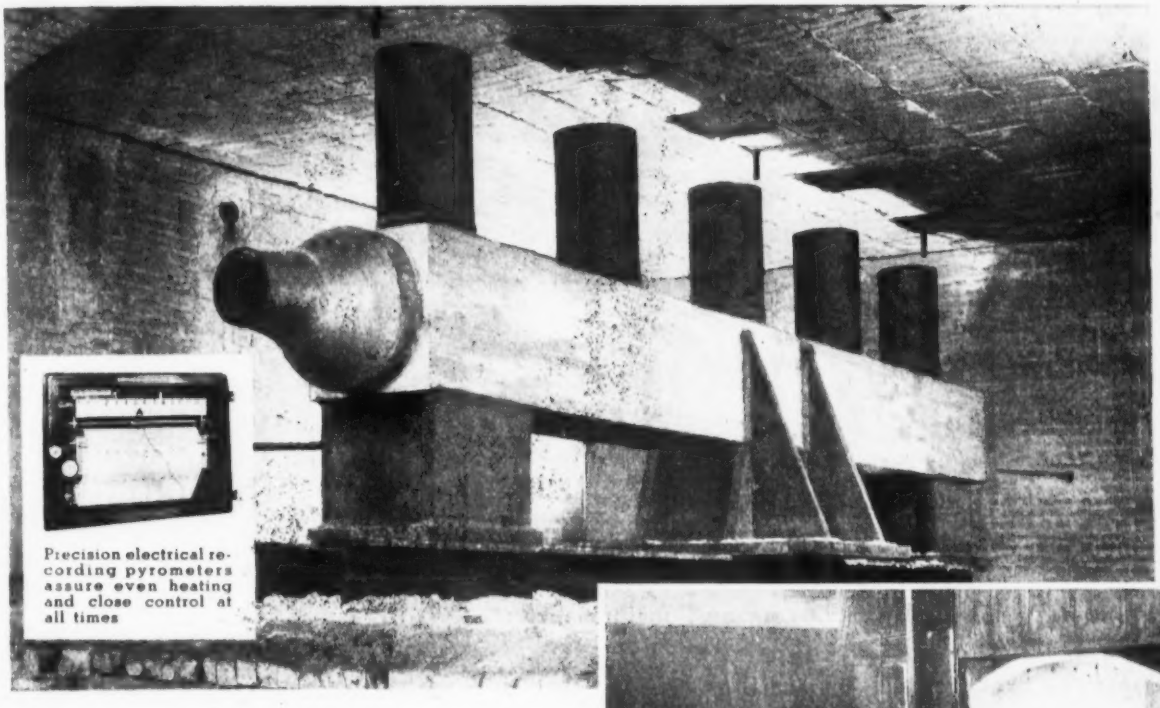
Division Sales Offices:
Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

GULF INDUSTRIAL LUBRICATION

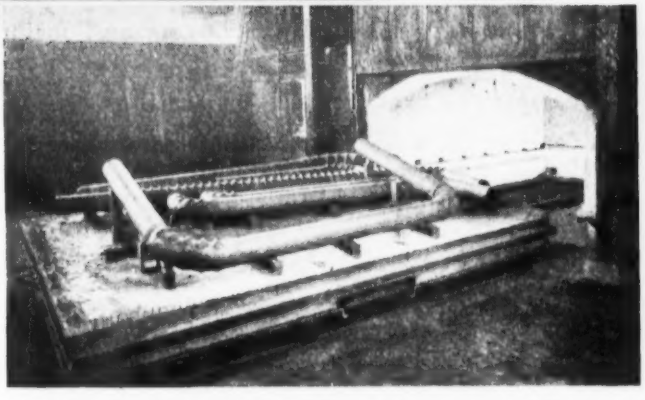
SHOP FABRICATION . . .

Means Added Protection

Controlled Heat-treating of Utmost Importance



Precision electrical recording pyrometers assure even heating and close control at all times



ABOVE: Group of Creased Bends and Corrugated Pipes being removed from the furnace.

TOP: 20" square forged carbon molybdenum header 18'7" long—in furnace. This header was heated to 1,250°F., held for 10 hours and slowly cooled. Thirty hours were required for the complete cycle.

SHOP fabrication of piping means added protection. Some processes and operations cannot be performed in the field. *All* operations and processes are best performed under controlled shop conditions.

For example, the specific heat treatment of materials for high pressure, high temperature piping is vital, not only to relieve internal stresses and strains induced by welding and other fabricating processes, but also in order to obtain the required grain size and physical properties.

Pittsburgh Piping & Equipment Company has modern furnace facilities for heat treating the largest bends and assemblies. They are operated under close control with automatic temperature recording instruments.

Regardless of the size of the unit to be handled, this equipment permits close control of heating, temperature maintenance, and cooling.

A carefully systematized procedure is followed in every phase of shop-fabrication of piping, which includes such operations as bending, Van Stoning, machining, pressure testing, inspection, and checking for dimensional accuracy, assuring an infinitely better piping job, whether it involves a single unit or a complete piping system. Our engineers will gladly work with you on any piping problem confronting you. Contact our nearest representative or write us direct.

Do More Than Before—Buy EXTRA War Bonds

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Occidental Building, Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
634 S. Gramercy Place, Los Angeles

- A damper that is TIGHT!
- A damper that makes by-passes practical.
- A damper that gives you absolute flow control.
- A damper that is as adaptable to old installations as it is to new ones.
- A damper that solves capacity, "outage," maintenance and other problems.
- A damper that pays for itself—by actual *proof.*
- A damper that makes possible these results through a new principle of design never before used. The name? HEACON DAMPER!

WRITE FOR HANDBOOK

Get the facts! See where and how Heacon Dampers save money, increase efficiency on many types of applications. You'll find this booklet interesting, helpful, informative. Write for it today!

THERMIX ENGINEERING COMPANY

Project and Sales Engineers

FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

HEACON GIVES CONTROLLED FLOW

1. MORE RELIABLE OPERATION
2. INCREASED CAPACITY
3. REDUCED MAINTENANCE
4. GREATER FLEXIBILITY
5. HIGHER EFFICIENCY
6. BETTER REGULATION
7. LOWER BANKING LOSSES
8. QUICKER STARTING
9. SAFER OPERATION
10. CLEARANCE WITHOUT LEAKAGE

HEACON INC

DAMPERS

FIELD PROJECT ENGINEERS:

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C. E. Johnson & Associate
Bona Allen Bldg.

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Ames & Holbrook
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R. S. Brookman
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The Lang Co.
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BRIGGS FULLER'S EARTH OIL CLARIFIERS

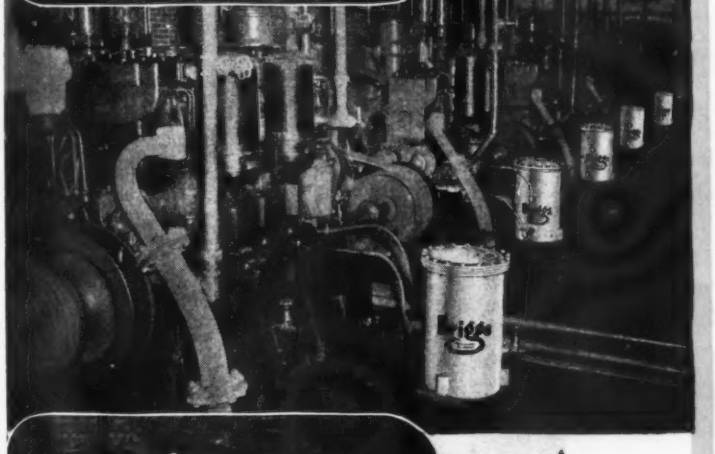
Save Over $1300.00 per Month for

MAGGIO ICE CO., BOSTON, MASS.

After six months of 24 hours a day operation, oil analysis shows oil is still in excellent condition

↑ Maggio Ice Co. plant. Capacity 210 tons of ice per 24 hr. day.

← DF-2-50-A Briggs Fuel Oil Clarifier. A unique installation whereby fuel oil is filtered from tank truck to storage tank and filtered again when pumped to engine.



↑ Engine room of Maggio Ice Co., showing two 170 HP and three 125 HP Cummins Diesels — all Briggs equipped.

← Close up of one of the D-3-AR-V5 Lube Oil Clarifiers installed by-pass off pressure line with cutoffs to eliminate engine stoppage while changing refills.

Figures tell an interesting story!

Previous to installing Briggs Clarifiers, it was necessary to change oil and completely clean lube system monthly. In dollars and cents—this cost Maggio Ice Company 1/5 of entire plant's 210 ton per day capacity for about 1½ days per month per engine or 7½ days. With ice selling at 30¢ per hundred pounds, the company lost $1,260.00 in sales. Each oil change cost, in oil, $45.00.

Briggs changed the picture. Oil has not been changed in six months. Briggs refill cartridges are changed without stopping engines. Fuel oil consumption averages 1,000 gallons per day. Refills in the Fuel Oil Clarifier have not been changed since installation.

Briggs Oil Clarifiers can make your operation more profitable. Get the facts about Briggs method of oil filtration from the Briggs representative nearest you. Look in the classified section of your phone book under "Filters" . . . or write manufacturer for information.

Briggs

PIONEERS IN MODERN OIL FILTRATION

BRIGGS CLARIFIER COMPANY

GENERAL OFFICES, WASHINGTON 7, D. C.

Distributors in Principal Cities

COMING OUT AT THE ELBOWS?

SIMPLY APPLY UNIBESTOS

it's simple to apply!

Unibestos, being sectional for virtually all size pipes, greatly simplifies the application of insulation to bends and elbows. You simply mitre sectional Unibestos to fit—the fibrous nature of the material used in Unibestos (amosite) makes for a more perfect seal; eliminates much of the need for filling in with plastic—requires only a *surface* application to finish it off in a neat, clean and efficient job.

UNION ASBESTOS
MEANS PROGRESS IN INSULATION
AND RUBBER CO.

COPYRIGHT 1944
UNION ASBESTOS AND RUBBER CO

PLANTS: 1821 S. 54th Ave., CICERO, ILL. • PATERSON, N. J. • BLUE ISLAND, ILL.
OFFICES: CHICAGO • CICERO, ILL. • NEW YORK • SAN FRANCISCO • PATERSON, N. J.

No landing deck for them!

"Eyes of the fleet" are the pilots of cruiser-based scouting planes. Catapulted into the air they seek out enemy ships; radio their location and the effect of our gunfire.

But that's just part of their job. On a flight that covers thousands of square miles of ocean they may bomb or strafe light vessels and submarines, machine gun Jap airplanes, lay smoke screens.

On return, scouting planes must land near the motherships to be picked up by crane. There is no landing deck on a cruiser. They must hit the water after every flight!

Part of Star's job for the Navy is building the compact, powerful, shock-resistant motors for the hoisting cranes. Because motor failure could mean the loss of planes and men, the Navy was a "tough customer" when specifications for motors were written. But Star met those specifications – can meet yours when you have a difficult motor problem. Star Electric Motor Company, 200 Bloomfield Avenue, Bloomfield, N. J.

SATISFYING THE WORLD'S TOUGHEST CUSTOMER

Wanted—Your Tough Motor Problems

Star motor, above, was designed with the cooperation of engineers of the McKiernan-Terry Corp., Harrison, N. J., to power the crane that lifts scouting planes aboard cruisers.

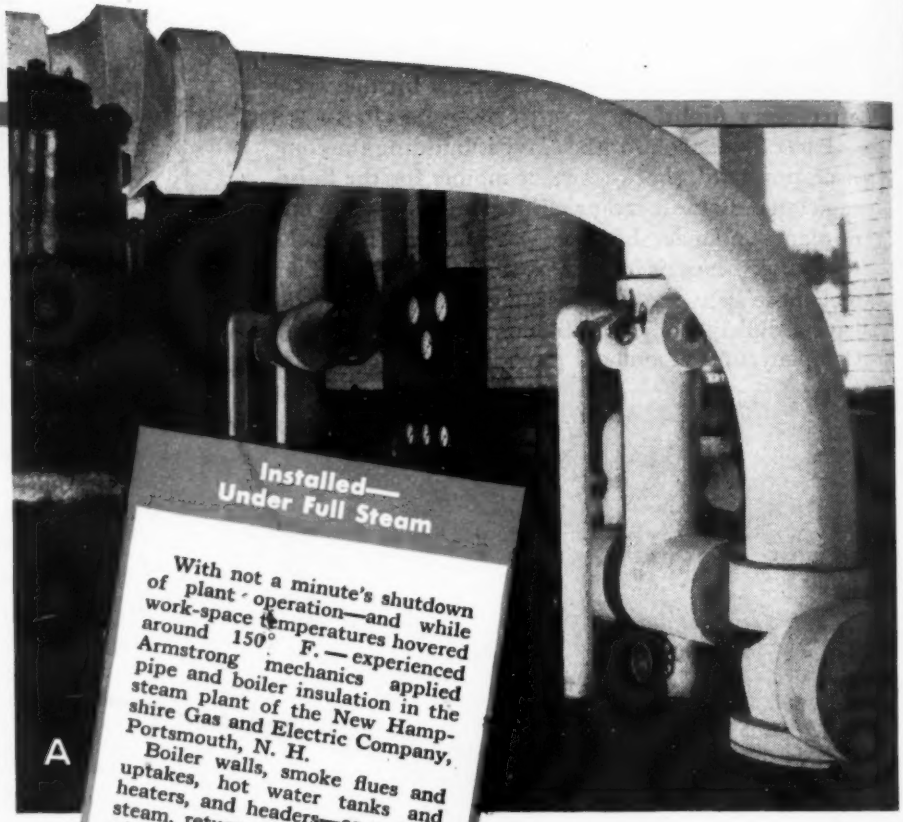
Dozens of other types of motors designed and built by Star, are used on U. S. warcraft. While the Navy does not endorse any product, the fact that Star consistently satisfies "the world's toughest customer – the U. S. Navy" – is ample proof of the engineering ability of this 34-year old organization. If a standard Star motor (⅛ to 200 h.p.) does not meet your exact requirements we have the ability and the willingness to build one that does! Consult Star now.

STAR MOTORS

You're sure of a dependable job with ARMSTRONG'S CONTRACT SERVICE FOR HEAT INSULATION

COMPLETE RESPONSIBILITY for the entire job rests on the shoulders of one large experienced organization when you use Armstrong's heat insulation contract service. This assures you of dependability in every detail of planning, supervision, materials, and workmanship. You enjoy the benefits of Armstrong's wide engineering background, materials of tested and proved efficiency, and experienced installation mechanics.

For complete details, write Armstrong Cork Co., Building Materials Division, 7002 Concord Street, Lancaster, Penna.



A

Installed— Under Full Steam

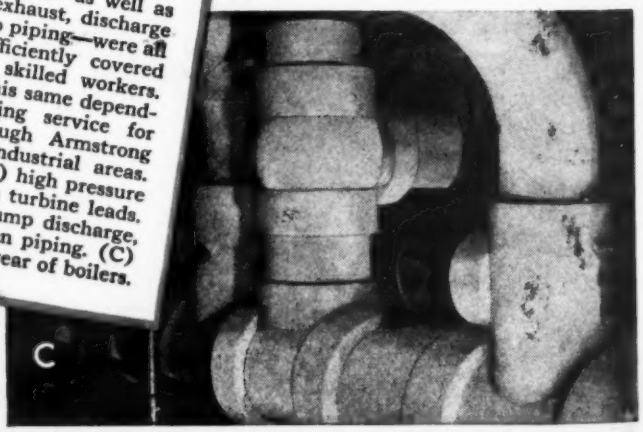
With not a minute's shutdown of plant operation—and while work-space temperatures hovered around 150° F.—experienced Armstrong mechanics applied pipe and boiler insulation in the steam plant of the New Hampshire Gas and Electric Company, Portsmouth, N. H.

Boiler walls, smoke flues and uptakes, hot water tanks and heaters, and headers—as well as steam, return, exhaust, discharge, suction, and drip piping—were all speedily and efficiently covered by Armstrong's skilled workers.

You can get this same dependable, money-saving service for YOUR job through Armstrong offices in most industrial areas.

Views show: (A) high pressure steam header with turbine leads. (B) Boiler feed pump discharge, exhaust, and suction piping. (C) Exhaust header at rear of boilers.

B

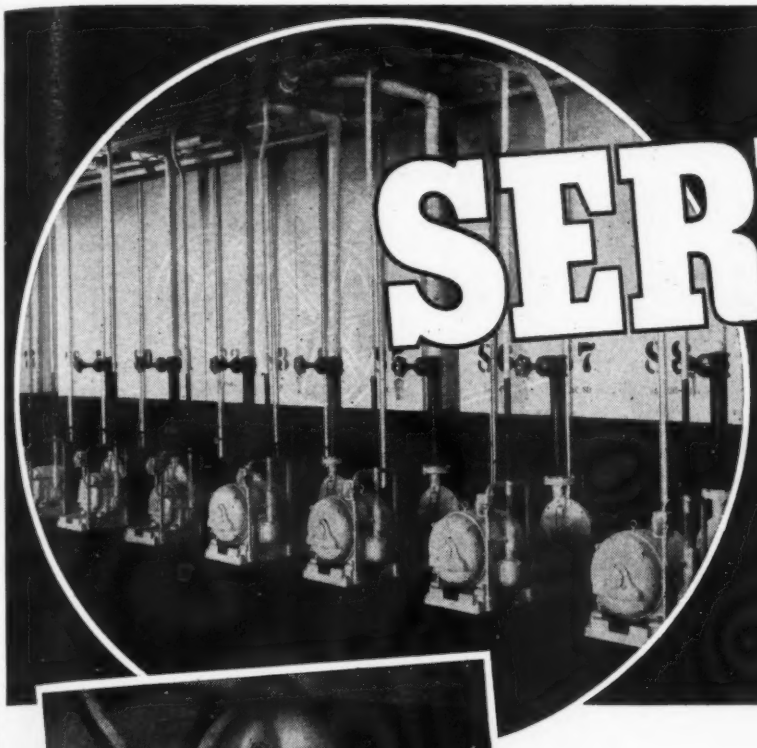


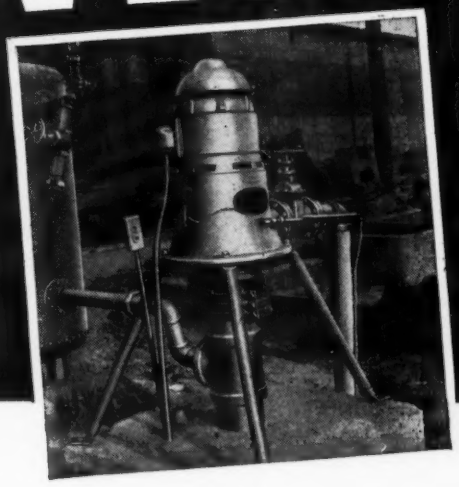
C

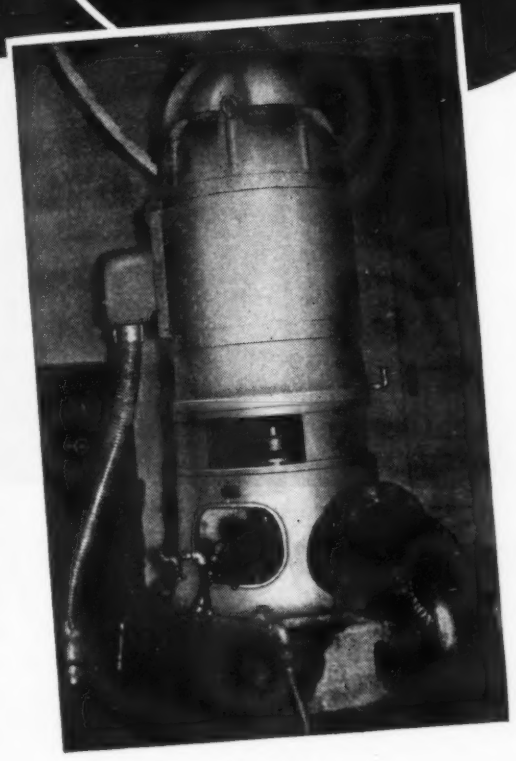
ARMSTRONG CORK COMPANY

Complete Insulation (A) Contract Service for All Temperatures, from 300° below zero to 2600°F.

SERVICE







Installed several years before the war, the Deming Turbine Pump, illustrated above, continues to give satisfactory service although exposed to wide variations in weather conditions in a northern State.

The battery of Deming Centrifugal Pumps of identical type and capacity shown in the circular view above have maintained exceptional uniformity of service . . . a demonstration of uniformly high standards of pump engineering and manufacturing.

Wartime records of Deming Turbine Pumps on water supply service for factories and for a variety of military and institutional buildings prove the exceptional dependability of these pumps under continuous operating schedules. A typical Deming Turbine Pump with standard head is illustrated at left.

The "shop-worn" word SERVICE takes on real meaning when applied to DEMING PUMPS. Refer YOUR pumping needs to DEMING for the high standard of SERVICE your operations demand.

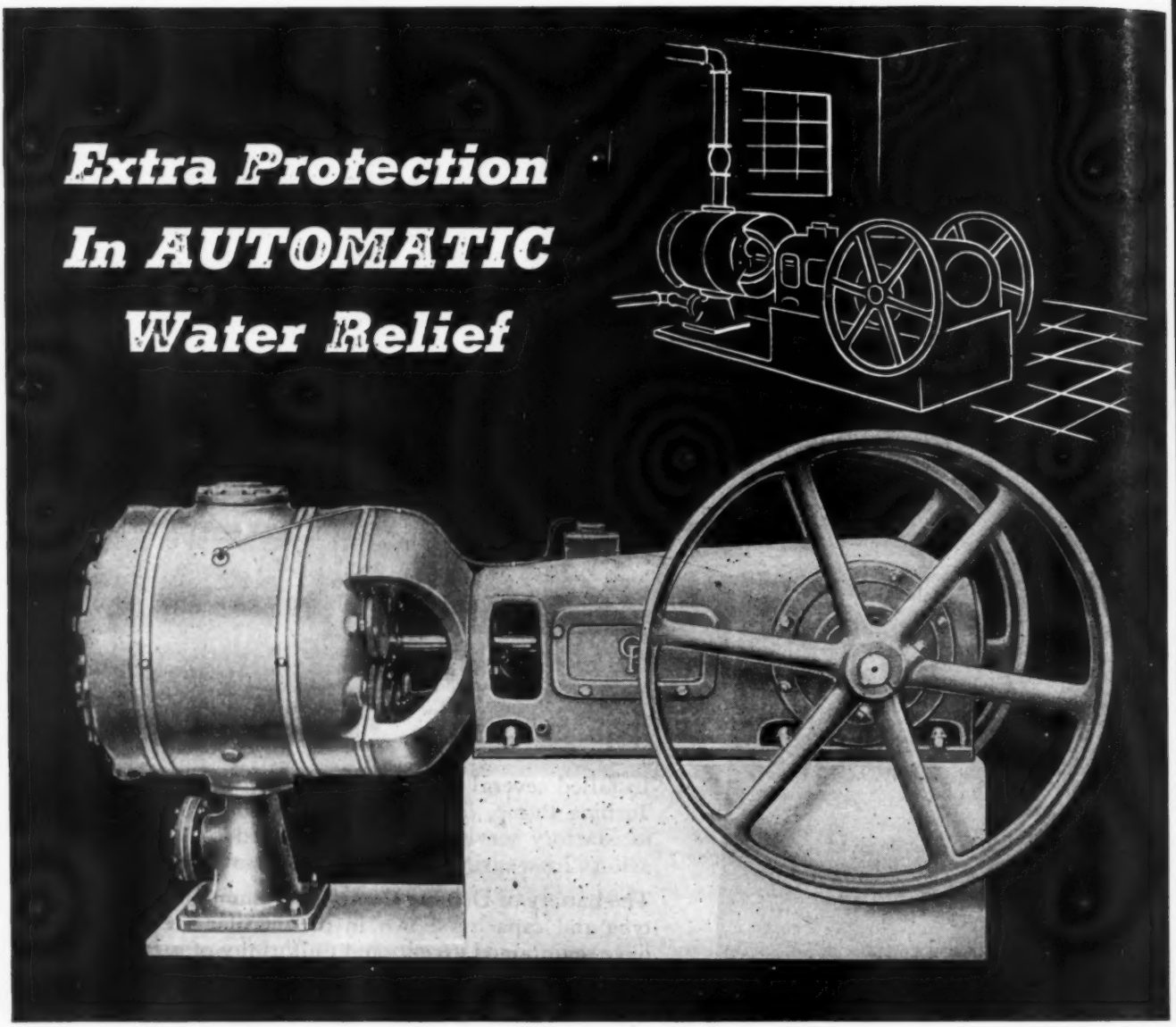
DEMING

THE COMPLETE LINE

PUMPS AND WATER SYSTEMS

The Deming Company • Salem, Ohio

Extra Protection In AUTOMATIC Water Relief



CP SINGLE AND DUPLEX DRY VACUUM PUMPS

ONE of the discharge assemblies in each end of the cylinder of a CP Horizontal Vacuum Pump is arranged as a special automatic valve. Should a slug of liquid be accidentally drawn into the cylinder the relief valve assembly will lift off its seat against a heavy spring, providing extra escape area for the liquid and minimizing the danger of damage to the pump. This is an exclusive CP feature.

The durable Simplate Valves are located in both cylinder heads parallel to the piston face, affording low valve clearance and high volumetric efficiency at high vacua.

Arranged for belt, motor or steam drive, CP Horizontal Single and Duplex Dry Vacuum Pumps are available in capacities up to 15,000 c.f.m. Two-stage pumps available for very high vacua. Write for complete information.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
HYDRAULIC TOOLS
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

REVOLUTION in Piston Packing

Darcova Pumcups Provide Scientific, Precision-Fitted Packing for Reciprocating Pumps and Hydraulic Pistons

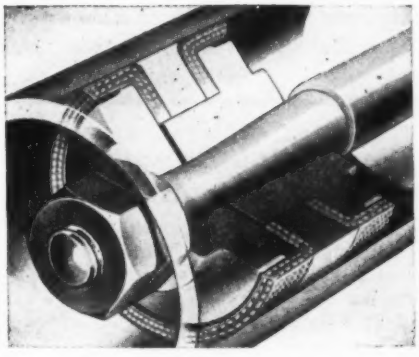
FOR centuries piston-packing has been a neglected science. Even James Watt, in 1769, was content with a cylinder bored to a tolerance of a shilling's width. Today there are just about as many methods of piston-packing as there are maintenance men.

But in 1940 Darling Valve & Manufacturing Company did something revolutionary. Darling had had forty years' experience making close-tolerance composition valve caps for oil well pumps. These cups had to work thousands of feet under ground, pumping oil through sand under high pressures, frequently under corrosive conditions. These composition cups became so well established that oil men called all valve cups by the Darling trade name, "DARCOVAS".

With this background, Darling in 1940 introduced a new, scientifically-designed pumping cup for reciprocating pumps and hydraulic cylinders. Made to unusually close tolerances, these cups fit exactly standard pumps and cylinders, with oversizes for rebored cylinders or liners. They are available in 70 sizes from 1" to 20", and come in three textures, with special sanitary finish for food or other special applications.

Installed in hundreds of plants all over the country, these cups are lasting from two to ten, sometimes even a hundred times longer than leather crimps, rubber cups, hydraulic packing, metal rings, plastic rings, and other types of piston packing. The extra service they give may extend for many months.

In scores of plants Pumcups have kept pumps and cylinders operating in tough



wartime service, and have eliminated costly delays and repairs. Pumcups successfully handle boiler feed water, sewage, brine, refrigerants, liquors, wines, milk, most alkalies and acids—practically all commonly used industrial fluids.

SPECIAL PISTONS—Darcova Pumcups can be used with standard cup-type piston design, but to enable the product to work at maximum efficiency, Darling manufactures iron, steel and bronze pistons which greatly lengthen the service and improve the performance given by Pumcups.

If you are concerned with frequent shutdowns for repacking pistons in pumps or hydraulic cylinders or if pump repacking bills and down-time are running to extremes, Darcova Pumcups can save you money and help keep your plant on stream.

Write for further information, and free Bulletin No. 4401. Or ask your local mill supply distributor about Darcova Pumcups.

NOTE THESE RESULTS:

One set of Pumcups in a Worthington pump in Illinois have lasted over 7,000 hours, have pumped more than 1,000,000 barrels of oil.

746 days wear vs. 10—*Pumping butane gas in a Dean Bros. Duplex 6 x 4 x 6 hydraulic packing lasted only 10 days, the liners about 60. One set of Pumcups lasted 746 days, liners still in perfect condition.*

26 weeks vs. 2 weeks—*A soap manufacturer pumps spent lye and slop with Pumcups. Former packing lasted two weeks, Pumcups from six to eight months (13 to 21 times longer). This company has standardized on Pumcups.*

120 days vs. 10 days—*Operating soaking pit covers in a Pittsburgh steel mill, hydraulic cylinder packing lasted ten days. Pumcups last more than 120 days. This mill is equipping all hydraulic cylinders with Pumcups.*

8 weeks vs. 2 weeks—*Handling abrasive lime slurry twenty-four hours a day, rubber piston cups in a 14 x 6 x 14 Gardner-Denver pump lasted only two weeks. Darcova Pumcups now last eight weeks on the average and liners last ten times longer than before.*

2,000 hours vs. 20 hours—*In a ceramic extrusion press, operating at 12,345 p.s.i., leather cups lasted four to twenty hours. Pumcups lasted over 2,000 hours. This plant is 100% Darcova equipped.*

48 weeks vs. 10 weeks—*On September 27, 1943, Pumcups were installed in one cylinder of a 3½ x 5 x 10 National Transit duplex feed water pump at Parkers Landing, Pa. Good quality, conventional hydraulic packing was installed in the other. The hydraulic packing had to be replaced after ten weeks. The Pumcups are still going strong after 48 weeks.*

DARCOVA TRADE MARK

THE ORIGINAL COMPOSITION CUP

DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

Darling Valve & Mfg. Co., Dept. E, Williamsport, Pa.

Gentlemen: I want to know more about Darcova Pumcups. Send your free Bulletin 4401 and name of local distributor.

Name_____

Company_____

Address_____

City_____ State_____

Makeshifts

versus

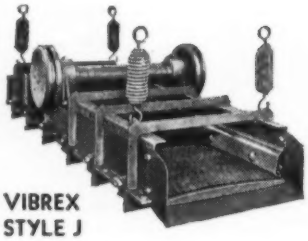
EQUIPMENT THAT FITS YOUR NEEDS

You know your plant—its problems, its capabilities, its needs. You, better than anyone else, know the kind of equipment that will best do your job—your way. And that's exactly what you get—when you come to Robins.

For Robins never tries to sell "misfits" or "makeshifts". Because Robins makes a complete line of machinery to meet practically every bulk materials handling need.

Take Screens, as an example. Robins not only makes many types, for a wide variety of purposes, but has contributed several innovations to this field, such as the invention of the Circle throw principle.

GYREX



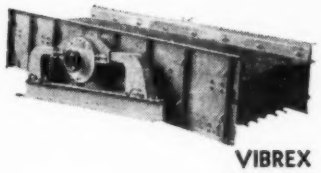
VIBREX
STYLE J

Through Robins you have your choice, for instance, of:

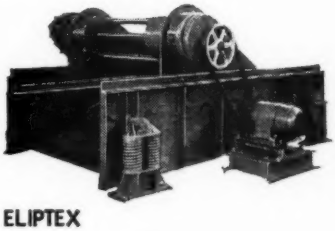
Gyrex Screens, using a positive eccentric principle: made with a steel or cast-iron base, for floor or suspended mountings; in sizes 24" x 54" to 72" x 192"; 1, 2 or 3 decks; capacities to 1000 tons per hour.

The Vibrex Screen, utilizing a centrifugal force created by offset counterweights. Made in Style J for suspended mounting, vibrator above or below frame, in sizes 24" x 48" to 24" x 72", single deck only; and in Style M for floor mounting, in sizes 36" x 78" to 48" x 120", 1 or 2 decks.

Then, for sharpest screening at high capacity, or for dewatering, the Robins Eliptex, employing an elliptical throw counter-to-flow of material. Requires less headroom. Made in sizes 36" x 96" to 72" x 192" with 1, 2 or 3 decks.



VIBREX
STYLE M



ELIPTEX

These Screens, as well as others in the Robins line, are adaptable to a wide range of cloth openings and weaves, to provide exactly the kind and size of Screen you need for every screening purpose.

So whatever your requirement—get in touch with Robins. If you already know what you want, it can be ordered from Robins with confidence. But if you believe your production processes might be improved, our engineering department will gladly survey your conditions and offer specific recommendations, based on years of experience with every kind of screening problem. When writing, please address Dept. **P-2.**

ENGINEERS, MANUFACTURERS AND ERECTORS OF MATERIALS HANDLING MACHINERY

ROBINS *makes:* BELT CONVEYORS · COAL AND ORE BRIDGES · BUCKET ELEVATORS · CAR AND BARGE HAULS · CAR DUMPERS · CAR RETARDERS · CASTINGS · CHUTES · CONVEYOR IDLERS AND PULLEYS · CRUSHERS · FEEDERS · FOUNDRY SHAKEOUTS · GATES · GEARS · GRAB BUCKETS · PIVOTED BUCKET CONVEYORS · VIBRATING SCREENS · SCREEN CLOTH · SELF-UNLOADING BOAT MECHANISMS · SKIP HOISTS · STORAGE AND RECLAIMING MACHINES AND SYSTEMS · TAKEUPS · LOADING AND UNLOADING TOWERS · TRIPPERS · WEIGH LARRIES · WINCHES · WINDLASSES

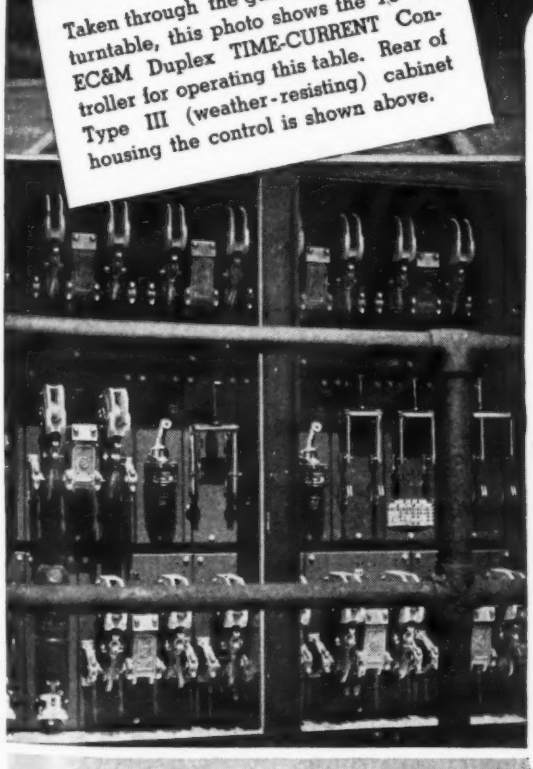
ROBINS
CONVEYORS
INCORPORATED
Founded in 1896 as Robins Conveying Belt Co.
PASSAIC • NEW JERSEY

FOR MATERIAL AID IN MATERIALS HANDLING . . . . . **It's ROBINS**

EC&M
DUPLEX-CONTROL

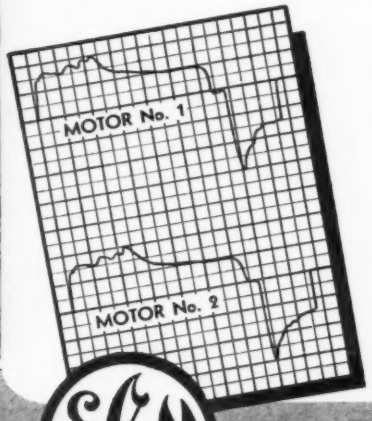
ASSURES EFFICIENT OPERATION OF 2-MOTOR ENGINE-TURNTABLE

Taken through the guard railing on the turntable, this photo shows the 70 HP EC&M Duplex TIME-CURRENT Controller for operating this table. Rear of Type III (weather-resisting) cabinet housing the control is shown above.



TO drive turntables serving engine roundhouses, two identical motors connected in parallel are generally used.

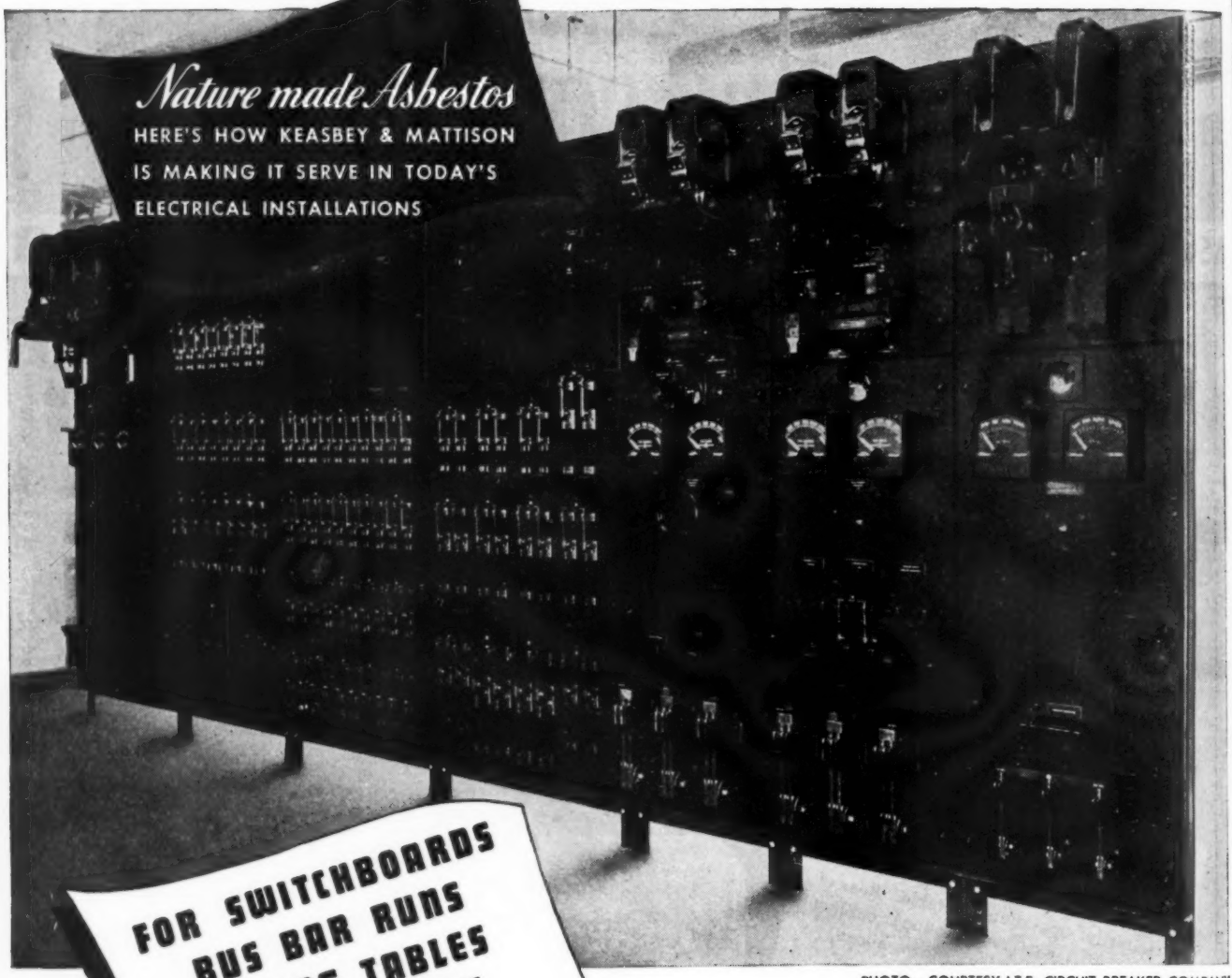
The graphic ammeter curves, below, show the efficient operation of these 2-motor drives obtained with EC&M Duplex Control. Superimposing one curve on top of the other shows that current values at any point on the curves—during starting, accelerating, running, or plugging—are practically duplicates of one another.



Duplex controllers are built for both a.c. and d.c. service. They are available, when desired, with transfer knife switches which permit isolation of either motor circuit for emergency single-motor operation. Complete information gladly furnished on request.

THE ELECTRIC CONTROLLER AND MANUFACTURING CO.

2698 EAST 79TH STREET CLEVELAND 4, OHIO



PHOTO—COURTESY I.T.E. CIRCUIT BREAKER COMPANY

use K&M EBONIZED ASBESTOS

Here's why! K&M Ebonized Asbestos is made especially for modern electrical insulation requirements. It consists of a perfectly proportioned combination of asbestos fibre, binding cement, insulating compound, molded under intense pressure into strong monolithic sheets.

Note these special features of K&M Ebonized Asbestos . . .

Exceptionally high dielectric strength.
Uniform density throughout.

Withstands severe shock, vibration and wide temperature variation.

Resists oil and water action.

Does not shrink, crack or bulge.

Expanded production facilities make K&M Ebonized Asbestos available for *immediate delivery*. Comes in thicknesses from 1/8" to 4", standard or special "panel" finish. Specially developed to meet technical requirements of the Underwriters Laboratories, Inc., when built into an assembled unit. For further information, write us.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

30 years of research, development and operating experience throughout the world are incorporated in the

COTTRELL INSTALLATIONS

offered to meet the requirements
of any problem by

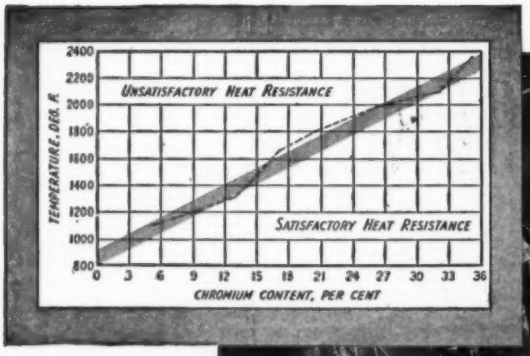
RESEARCH CORPORATION

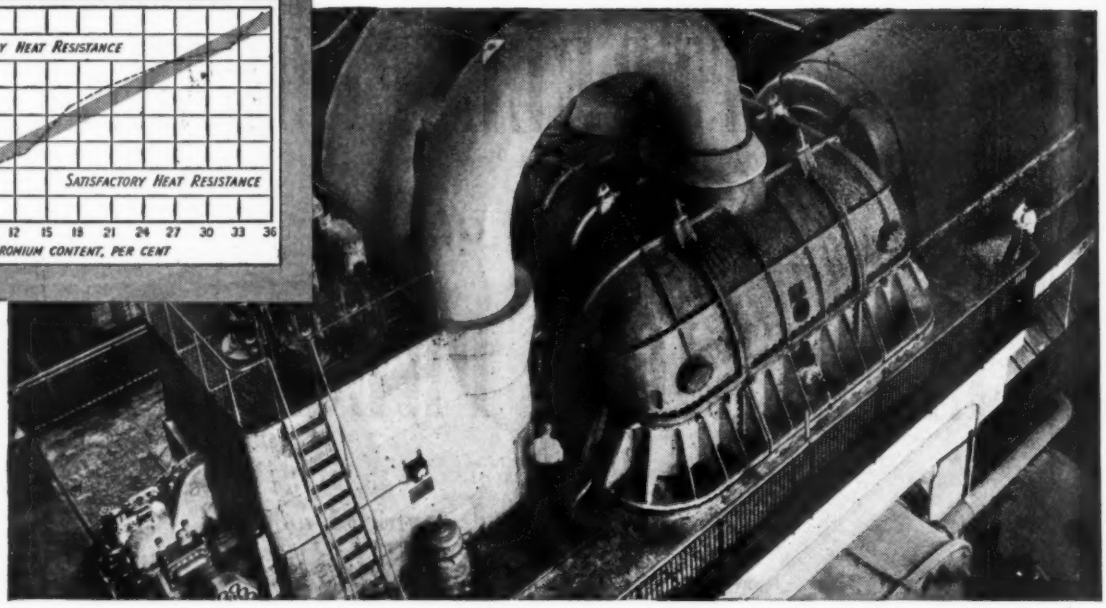
405 LEXINGTON AVENUE
NEW YORK CITY

59 EAST VAN BUREN STREET
CHICAGO, ILL.

ON HOT JOBS . . .

Chromium Safeguards Equipment





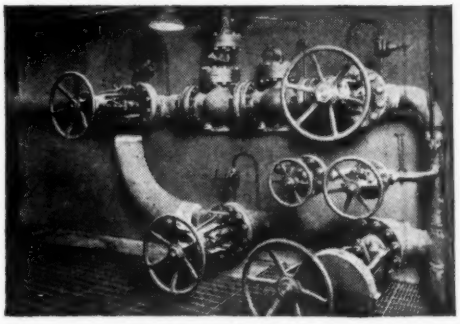
This giant turbine has blades of corrosion-resistant chromium steel.

• Chromium irons and steels can stave off the oxidation that ruins power equipment where high temperatures are encountered. Stainless steel turbine blades withstand the corroding and eroding effect of superheated steam. Even the high pressure and extreme temperature to which convection superheater tubes are subjected will not affect the chromium steel of which they are made. Chromium cast iron stoker parts resist abrasion and growth in the heat of furnaces.

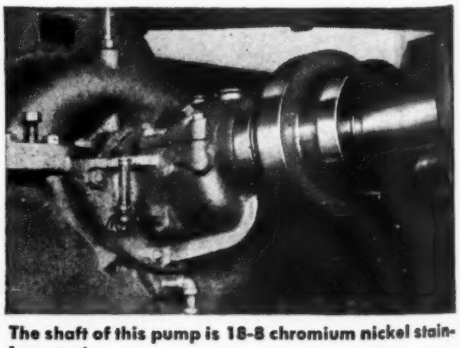
Baffle castings, pump parts, valves, boilers, spacer castings, and tile supports, — all are made of chromium iron or steel to meet severe conditions.

Although we do not make iron or steel, we have produced ferro-alloys for many years and have accumulated a vast fund of data on the alloy steels in which they are used. The benefit of our experience is available to help the fabricators and users of equipment subject to extreme conditions. Write to us for further information.

BUY UNITED STATES WAR BONDS AND STAMPS



Valve stems and discs of this "valve nest" on a high pressure boiler are of stainless steel.



The shaft of this pump is 18-8 chromium nickel stainless steel.

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Electromet
Trade Mark
Ferro-Alloys & Metals

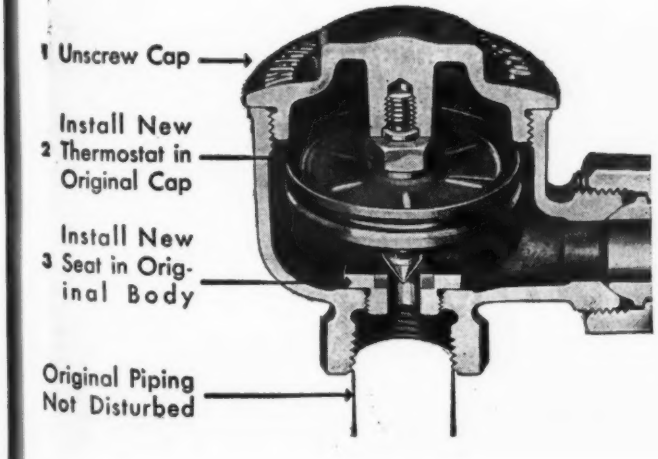
Fuel is Scarce This Winter

Nobody can afford the steam waste from even one worn out or obsolete radiator trap. Not this year with fuel scarcity a grim reality.

Make a thorough and careful check-up on the performance of every radiator trap in the system—*and do it now*. If there is any sign of leakage—anywhere—arrange now to replace worn or nicked seats and valves with new Webster Equipment.

Webster Traps are repaired right on the job. It is not necessary to disturb piping connections. Here is all that needs to be done:

First, turn off the radiator and allow it to cool. Then, unscrew cap of radiator trap and install new thermostat. Install new seat . . . That is all—and we furnish written instructions and will lend the installer any special tools required.


1 Unscrew Cap
2 Install New Thermostat in Original Cap
3 Install New Seat in Original Body
Original Piping Not Disturbed

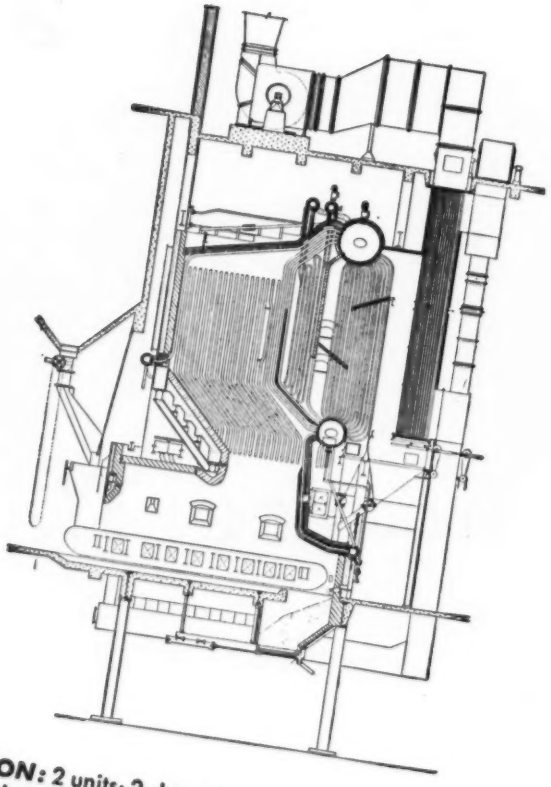
Properly operating radiator traps hold steam in radiators till it has given up all of its useful heat . . . Insure against waste of "live" steam and loss of valuable fuel . . . Help get comfortable heat even with curtailed fuel supply.

Webster Representatives in principal cities are trained heating specialists whose services are available to help keep heating systems in first-class operating condition. Consult the phone book. Or write for booklet, "How Much Steam Waste in Your Heating System." ADDRESS Dept. P-2.

WARREN WEBSTER & COMPANY, Camden, N. J.
Pioneers of the Vacuum System of Steam Heating :: Representatives in principal cities :: Darling Bros., Ltd., Montreal, Canada

By the makers of
Webster
Systems of Steam Heating

EDGE MOOR WATER TUBE BOILERS



THIS INSTALLATION: 2 units; 2-drum, bent tube, with superheater, water walls, vertical tubular air preheater.

CAPACITY	75,000 lbs. steam per hour
DRUM PRESSURE	450 psi.
DEGREES OF SUPERHEAT	300
FINAL STEAM TEMPERATURE	750° F.

These boilers are equipped with chain grate stokers and Edge Moor vertical tubular air preheaters for the efficient burning of lighite fuel.

- Edge Moor Boilers are designed for any required capacity and up to 900 lbs. drum pressure. Complete steam generating units are available, including boilers, superheaters, water walls, economizers and air preheaters.

STEAM GENERATING EQUIPMENT

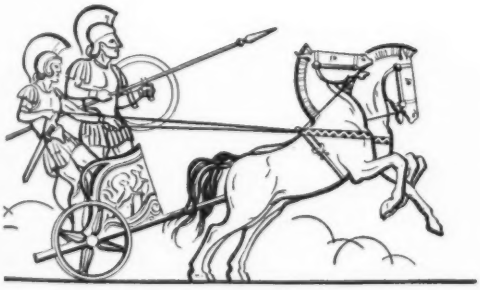
EDGE MOOR

IRON WORKS, INC.

BRANCH OFFICES: NEW YORK 20, N. Y.: 30 ROCKEFELLER PLAZA
CHICAGO 2, ILL.: ONE NORTH LA SALLE STREET

MAIN OFFICE: EDGE MOOR, DELAWARE

The Greeks had a word for it!



The ancient Greek warrior in his chariot, and below, his modern counterpart, the American soldier in an amphibian tank armored with Youngstown steel.

"SIDEROS"--meaning literally "metal from heaven"--was the ancient Greek word for Steel. It had its origin in meteoric iron. It was a precious metal, rarer than silver or gold. Iron, hardened into steel at crude forges, was shaped into spearheads and swords.

Superiority in the use of steel enabled the little armies of the Greek city states to throw back across the Bosphorus and eventually destroy the barbarian hordes of Persia, bent on conquest of the ancient world.

Today, an ever increasing superiority in the use of steel is enabling America and her allies to destroy the twentieth century barbarian enemies of modern civilization.

Tomorrow, with an overwhelming superiority in the use of steel, America must insist on remaining strong and free--to use its steel to preserve a lasting peace and to build a civilization better than any the world has ever seen.

QUALITY YOUNGSTOWN SERVICE

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

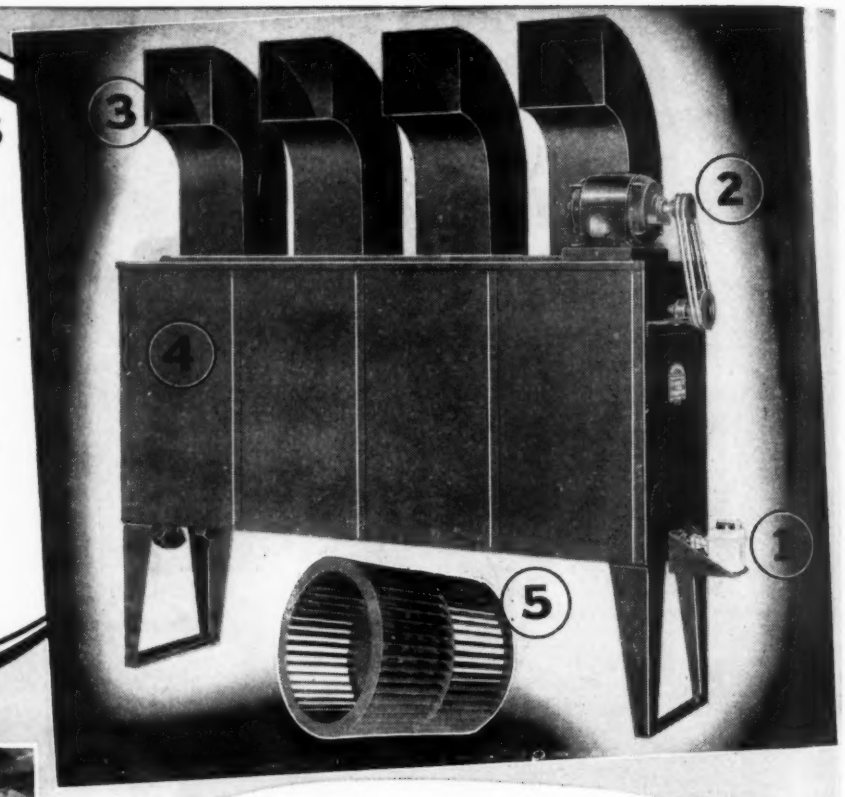
Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Electrolytic Tin Plate - Coke Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes - Alloy and Yoloy Steels.

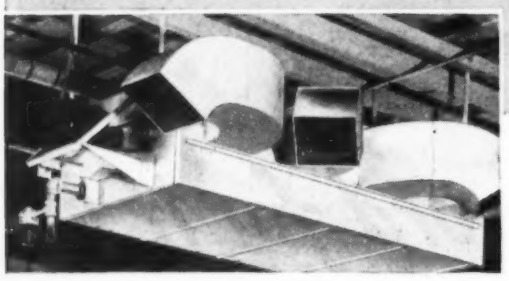
Give These Features Some Study - and

REDUCE

Your Heating

COSTS!





Floor or Ceiling Installation

Unitherm Heaters can be furnished either as floor or suspended type units. Floor type units are preferable where space permits. They are slightly more efficient in operation, and they simplify your layout considerably saving in pipe and trap costs. Suspended type units can be easily installed along walls or at ceiling line.

CLARCO HEATERS for SMALLER JOBS

These propeller type, suspended units are adaptable for small space heating and for places where more heat is required than present equipment can supply. Also suitable for heating offices and stores. Very quiet in operation. Easily installed along side walls or at ceiling line.

CLARAGE

Unitherm Heaters Offer:

1. **Syncrotherm Control:** temperatures regulated by the amounts of return air passing through or/and around heating coil. Constant warm air circulation; no stopping and starting of fans. Effective heating with LOWER temperature air; *important fuel savings.* Patented device obtainable only on Clarage Unitherm units.
2. **V-Belt Drive:** permits regulation of fan speed to meet widely varying conditions; insures QUIETER operation. (Direct drive if desired.)
3. **Square Outlets:** easily removable and adjustable for four different directions of heat flow.
4. **All Parts Readily Accessible:** merely remove front (or back) section of heater casing which is fastened to frame with machine screws.
5. **Centrifugal Fans:** one for each heater outlet. Pressure type delivering heat at high velocity over wide areas.

*Liberal range of sizes to meet all kinds of industrial heating jobs, operating on steam or hot water. Prompt deliveries. Have Clarage engineers submit complete recommendation. Write or phone us today!

ARMY E NAVY

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

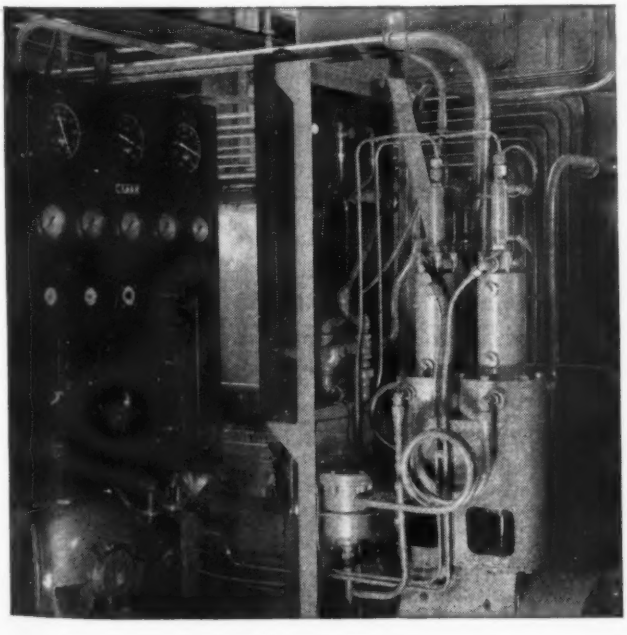
Clarage Fan Company Kalamazoo 16, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

How cold is 320° below?

WHAT'S it like at −320°F? And how do you measure it *accurately* under severe field conditions?

This was a question that had never come up until we were handed a neat little problem by Clark Bros. Co. and the M. W. Kellogg Co. in connection with a highly important piece of U. S. Army equipment, the purpose of which cannot be disclosed. It was an interesting challenge. Nevertheless, our long experience in designing tube systems to meet the unusual demands of industry permitted us to take the job in our stride. To be sure, it took some "doing" to provide the necessary over-range protection to withstand atmospheric temperatures as high as 150°F. when not in service; to produce the calibrating equipment; and to determine which metals would perform safely when exposed to such low temperatures.



Not all of our work is this spectacular. But the point we wish to make is that this particular job is another interesting, and entirely practical, application of tube system type instruments, and the versatility of Taylor Engineers.

Whether *you* want to plumb the depths of unexplored low temperatures—or measure or control any temperatures from there on up to 1000°F.—you can depend on Taylor capillary type thermal elements. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

ARMY E NAVY

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

BUY MORE WAR BONDS — AND KEEP 'EM

Section of Warren Pump installations on oil circulating and cleaning system at Boston plant of Gillette Safety Razor Co. A similar installation has been made at their Argentine plant.

WARREN

TRADE Gillette MARK

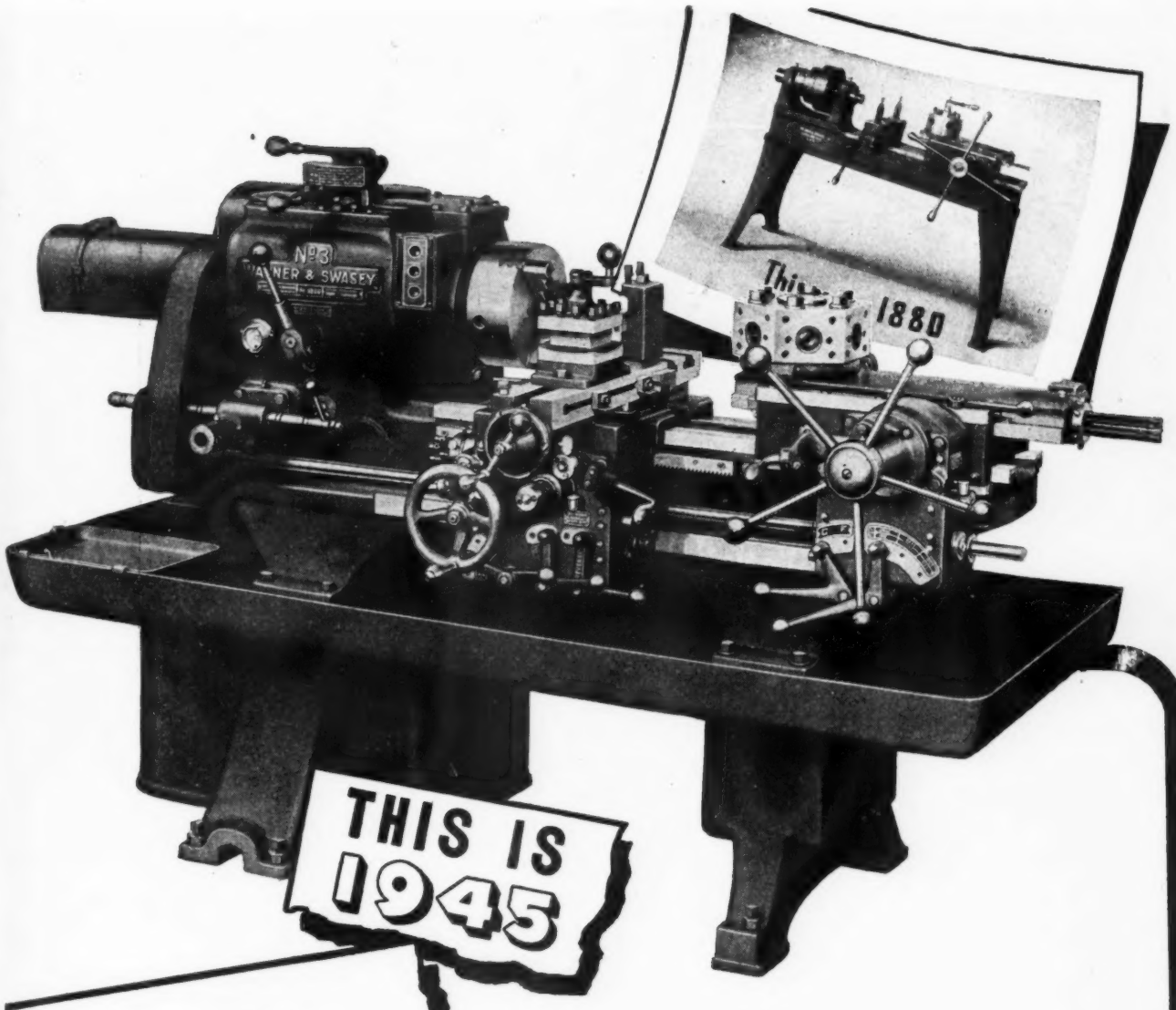
IT'S *Performance* THAT *Counts . . .*

Whether it's Pumps or Safety Razor Blades! You can be sure of top-flight performance in both if you insist upon WARREN and GILLETTE. Gillette is the largest manufacturer of razors and blades in the world. Of course, there is a reason for this dominance in their field . . . just as there is a reason why Gillette and so many widely diversified industries standardize on Warren Pumps in their process as well as power plant equipment . . . PERFORMANCE . . . TROUBLE-FREE performance, year after year, is the answer . . . made possible in the first place by sound, constructive application engineering.

ARMY E NAVY

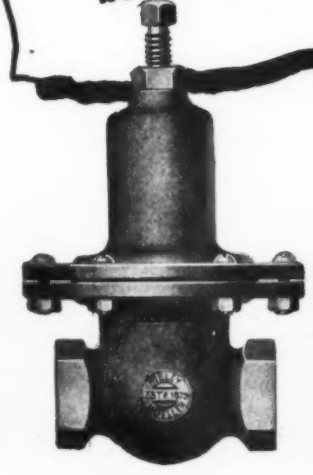
WARREN STEAM PUMP CO., INC.

WARREN, MASSACHUSETTS



THIS IS 1945

. . . and these better machines make K & M controls better TODAY!



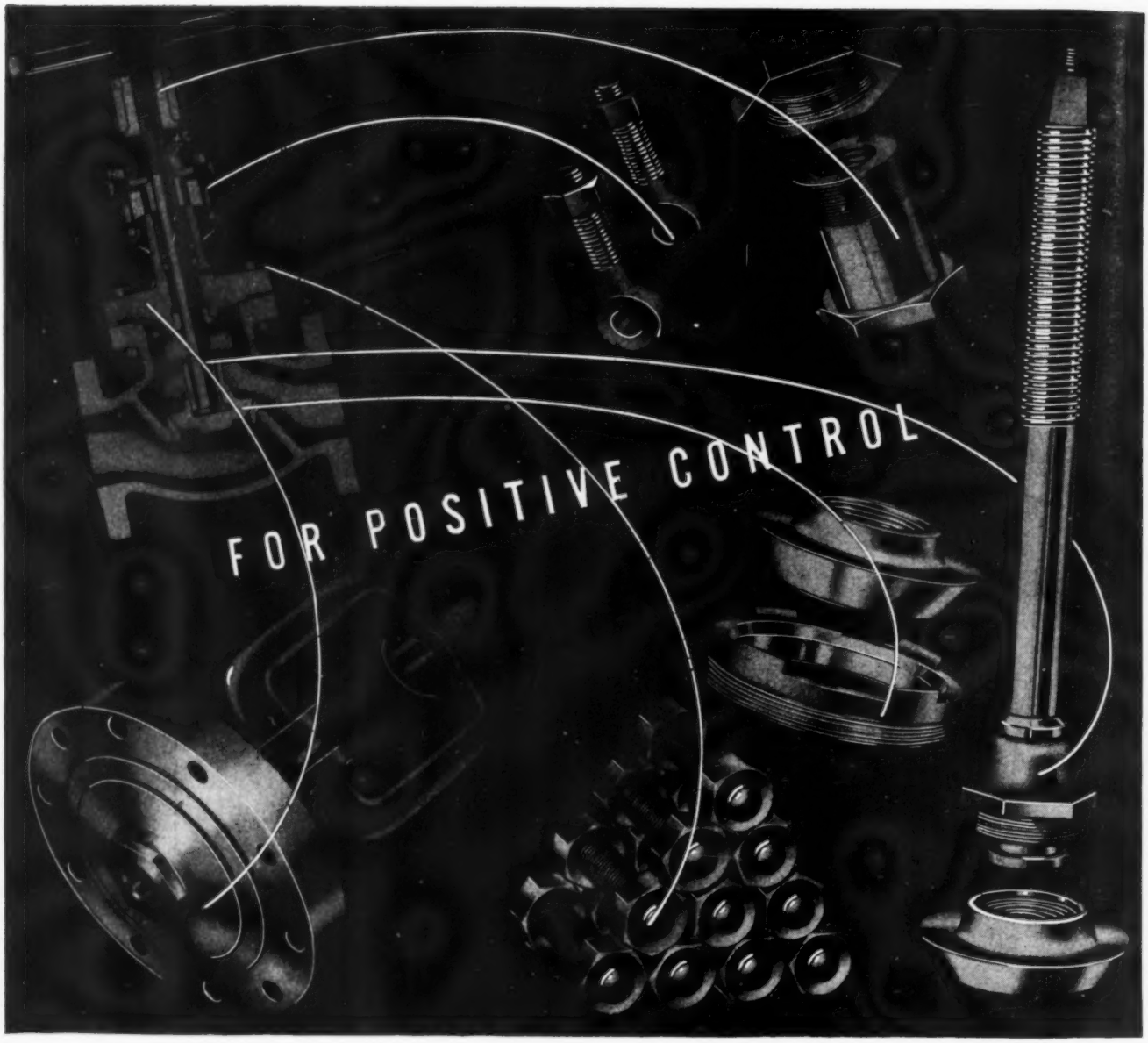
Built into every K & M Control is *experience plus* . . . not merely our own 66 rich years of pioneering and progress . . . but all the benefits of the know-how of other seasoned old-timers. For instance, Warner & Swasey. We've used their turret lathes since 1880, starting with the plain little fellow up above. Our new plant uses big babies that tool to a ten-thousandth. Dependable as they've always been, K & M Controls are better than ever today! Pictured is the compact K & M type 590 Diaphragm Relief Valve for pressures from 5 to 100 lbs., with a wide range of adjustability above or below pressures desired. Sizes ⅜" to 2"—angle or globe—set screw, hand wheel or test lever adjustment—with discs and diaphragms suitable for steam, water, air, oil or gas service.

KIELEY & MUELLER, INC.

MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS SINCE 1879

2001 43rd St. **North Bergen, N. J.**

66 YEARS OF CONTROL PROGRESS



ACCURATE and positive control of fluid flow over a broad range of throttling and full-flow services is assured with OIC Cast Steel Globe and Angle Valves.

Spherical Type discs and seat rings for full-area open-and-closed service . . . Plug Type for throttling and high-velocity flow. *Both* designs are available in a number of trims, adapted to the control of steam, water, oil or oil vapor at temperatures up to 1000°F. Proper selection of seat design and trim assures that the OIC Steel Globe or Angle Valve chosen for your service will give the maximum in performance and trouble-free operating life.

In addition to an unusual flexibility of application, these valves offer the regular OIC construction features . . . unobstructed waterways . . . strong, safe bonnet joints with through bolt-studs . . . durable, smooth-operating stem threads . . . convenient, time-saving repacking feature.

OIC Cast Steel Globe and Angle Valves, and their companion Gate and Swing Check Valves, are available in the 150 and 300-Pound pressure classes.

Trim specifications available on request.

There is an OIC Distributor near you, ready to demonstrate to you the many superior features of OIC Cast Steel Valves. Call him . . . or write to us for details.

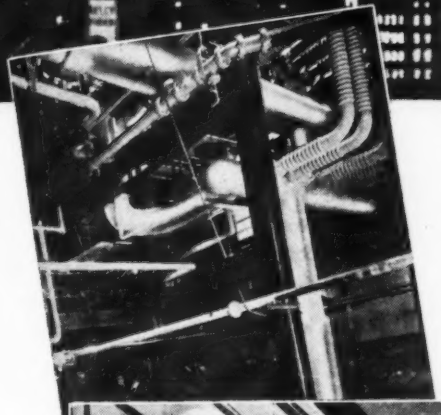
ARMY E NAVY

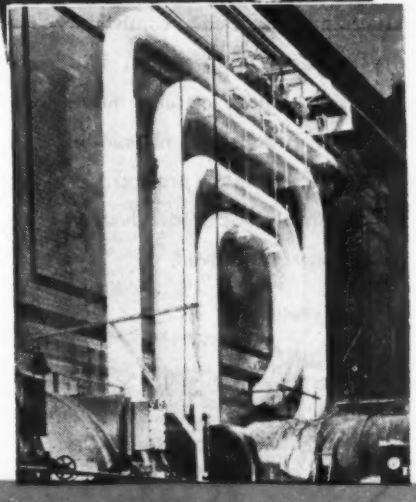
OIC

THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

Quality Leaders in Valve Manufacture Since 1883





THE Kellogg Scientific Method of solving tough piping problems has enabled central stations, process and marine power plants to successfully meet wartime emergency needs.

Kellogg prefabricated piping systems simplify piping problems because they conserve space—minimize joint stresses—provide safe connections to equipment unable to stand high forces or moments due to expansion—and give flexibility and complete reliability.

Consulting engineers, power process and marine engineers recognize the Kellogg trade mark as a symbol of scientifically designed piping.

KELLOGG

"Masterflex" Prefabricated Piping Systems · "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units · JUIK Processes for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY · JERSEY CITY, NEW JERSEY · 225 BROADWAY, NEW YORK 7, N. Y.

REPRESENTATIVES

LOS ANGELES: 609 SOUTH GRAND

TULSA: PHILTOWER BLDG.

CAN YOU SOLVE THIS ONE?
A train leaves New York every day for San Francisco at the same time a train leaves San Francisco for New York. These trains require seven days to cross the continent. (For instance, the train leaving Monday arrives at its destination the following Sunday evening.) If you were on the train leaving New York on Monday — how many eastbound trains would you meet by the time you pulled into San Francisco?

Many problems in the application of industrial rubber products have been solved within the broad scope of the Thermoid Line*. Thermoid representatives in all parts of the country have had long experience in specifying the most efficient Thermoid Products for all types of installations. Working hand in hand with these representatives, Thermoid's Engineering and Research Staffs guide Thermoid's extensive manufacturing facilities in the successful solution of countless industrial rubber products problems.

This combination has been consistently successful in widely diversified fields. Thermoid has produced results where results meant either an improvement in production technique or an improvement in the finished product. Why not talk over your industrial rubber products problem with the Thermoid representative?

Solution to train puzzle: 14

Thermoid Rubber

DON'T PUT IT OFF 'TIL TOMORROW *Buy More War Bonds Today!*

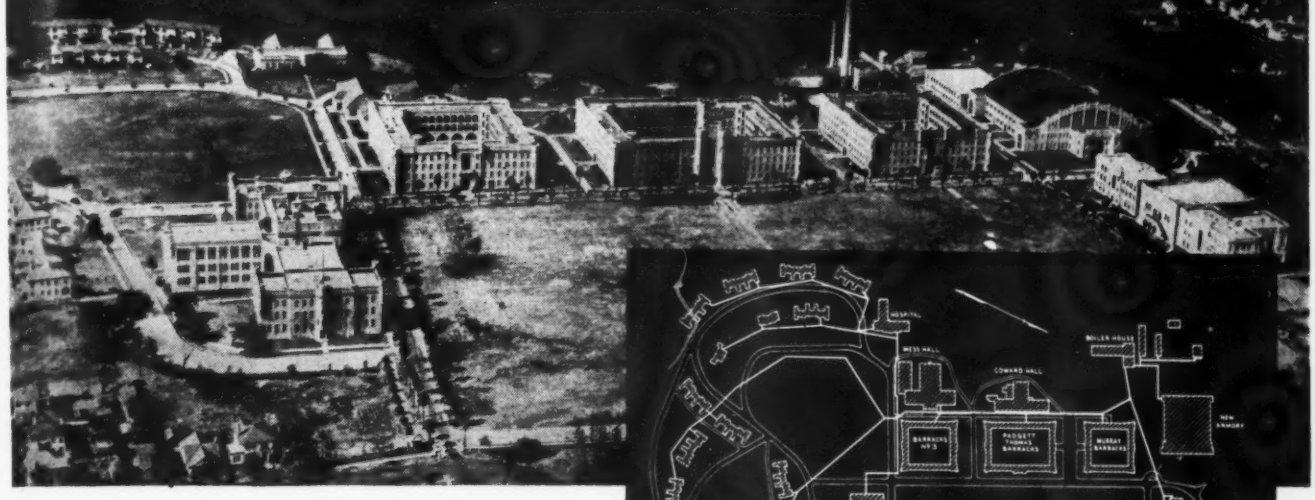
IT'S GOOD BUSINESS TO DO BUSINESS WITH THERMOID

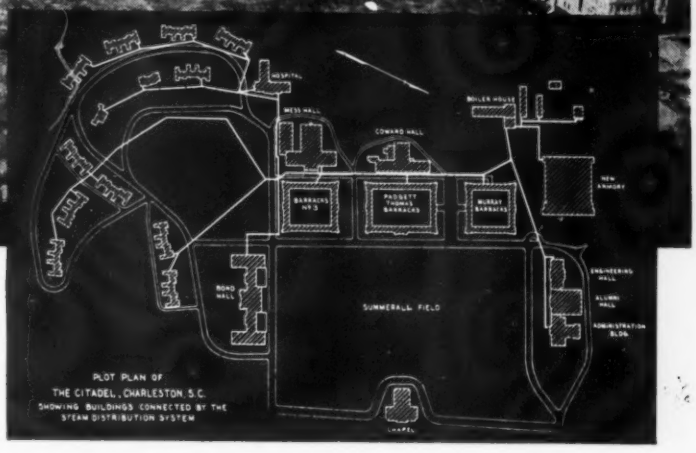
DIVISION OF THERMOID COMPANY
TRENTON, NEW JERSEY

*THE THERMOID LINE INCLUDES: TRANSMISSION BELTING • F. H. P. AND MULTIPLE V-BELTS AND DRIVES • CONVEYOR BELTING • ELEVATOR BELTING • WRAPPED AND MOLDED HOSE • SHEET PACKINGS • INDUSTRIAL BRAKE LININGS AND FRICTION PRODUCTS • MOLDED HARD RUBBER AND PLASTIC PRODUCTS.

Central Heating at the Citadel

SUGGESTS AN IDEAL POSTWAR MODERNIZATION PROJECT *for INSTITUTIONS*





PLOT PLAN OF THE CITADEL, CHARLESTON, S.C. SHOWING BUILDINGS CONNECTED BY THE STEAM DISTRIBUTION SYSTEM

RIC-WIL CONDUIT INSULATES AND PROTECTS STEAM PIPING *to buildings on 78 ACRE Campus*

Steam Pipe Line being installed in Ric-wiL Tile Conduit at the Citadel.

The Citadel, The Military College of South Carolina founded in 1842, was one of the pioneer institutions to incorporate the advantages of central heating—installing such a system in 1904. Greatly enlarged, this system is still giving satisfactory service.

In 1920, planners of the new Citadel, looking far into the future, provided central heating for the new home of the college as a matter of course. New additions in 1926-27, 1936-37 and subsequently have made necessary expansion of the central plant and distribution lines. Today every permanent building on the campus except the chapel, is heated from the central plant.

Any Institution Can Enjoy These Advantages of Central Heating:

- **Savings of 15% or better in overall fuel consumption.**
- **Elimination of separate boiler tending for each building unit.**
- **Elimination of smoke and soot which destroy original beauty of buildings.**
- **Increase of available space in building basements.**
- **Elimination of coal delivery and ash removal from buildings.**
- **Uniform, clean heat provided quickly, whenever needed.**
- **Central unfailing source of hot water.**

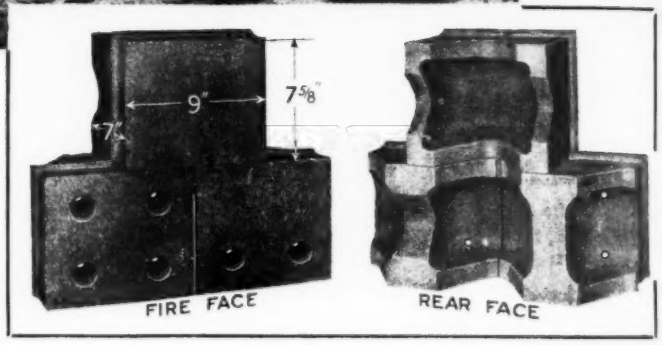
Engineers and architects with present or post-war projects on their boards, will find the new Ric-wiL Catalog No. 44 a valuable source of information on efficient Central Heat Distribution for institutions, industrial or commercial building groups, housing projects and municipalities.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

HAVE YOU A CLINKER ADHESION PROBLEM?

ABOVE: Front furnace wall, built with Bernitz Super Blocks, after 26 months' operation

AT RIGHT: How Bernitz "S-100" Blocks are laid "T & U." Differing from all "T" construction, the bond is broken by the blocks themselves



How the sum of many little problems becomes a BIG one

Clinker adhesion on furnace walls is a major problem these days because it shortens the life of the setting; causes outage for cleaning and repair; requires more time and labor during cleaning periods; cuts the capacity of the unit, and raises the cost of generating steam.

Moreover, the coals generally are of poorer quality than in pre-war days, and there is little hope for improvement in the near future.

Some plants also have trouble keeping crews to do the heavy labor necessary to keep their furnaces in workable condition between regular shutdown periods.

Bernitz SUPER BLOCKS are helping lick these problems in many hundreds of plants today. They are made of "Carbofrax," the Silicon Carbide refractory which inherently resists clinker adhesion. Their high thermal conductivity and correct design permit effective cooling, promoting a long life of usefulness.

Absence of clinker formation on walls built with Bernitz Blocks reduces cleaning time to a minimum. All of the grate surface is available for burning fuel all of the time, and full capacity of the unit can be maintained during the entire operating period.

BERNITZ
FURNACE LININGS

BERNITZ FURNACE APPLIANCE CO., 89 BROAD ST., BOSTON 10, MASS.

New York Philadelphia Detroit Buffalo Syracuse Atlanta Pittsburgh Cincinnati Chicago Indianapolis Minneapolis St. Louis Cleveland

In Canada: Williams & Wilson, Ltd., Montreal and Toronto

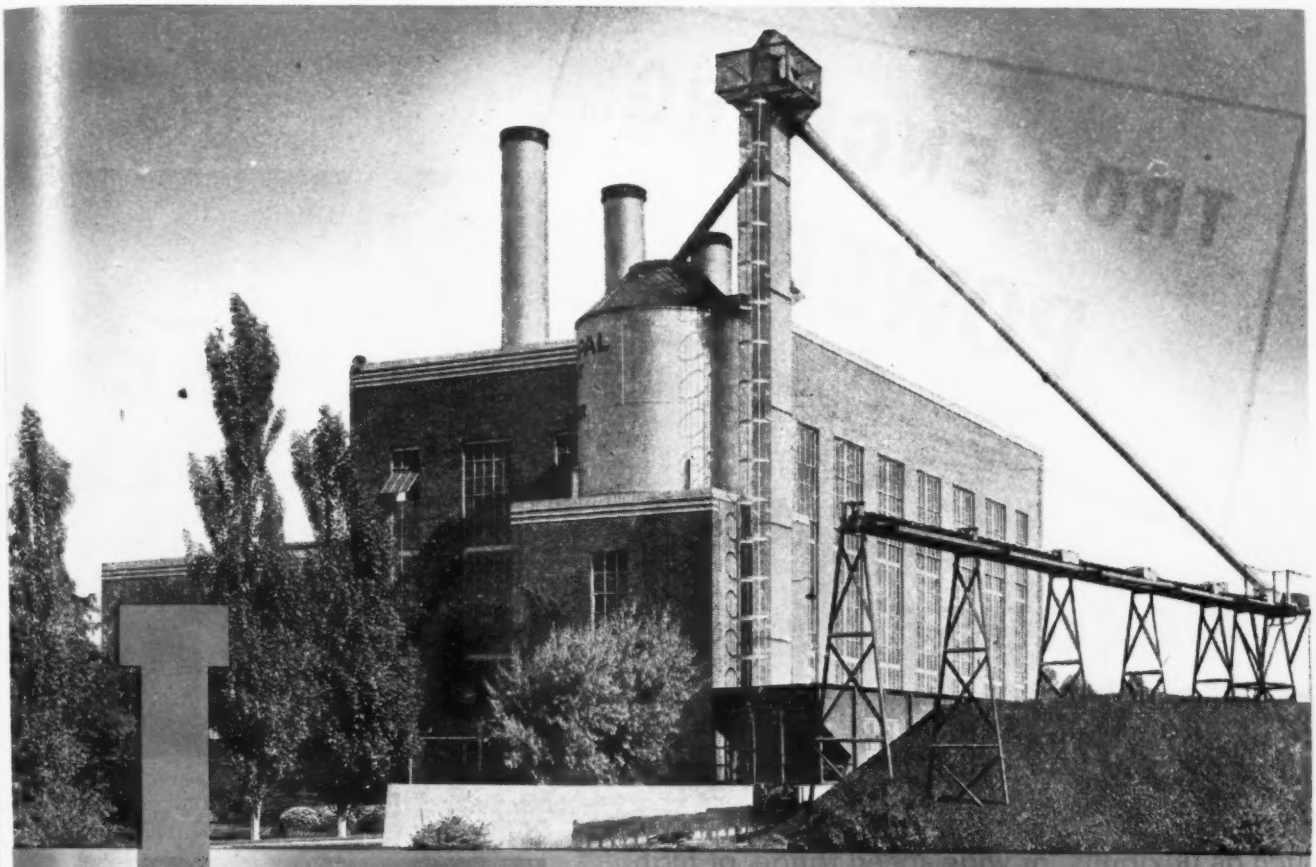
BERNITZ CO. PRODUCTS *include:*

Bernitz Super Blocks, Air Cooled

Bernitz Nygaard Water Wall Blocks for Walls & Arches

Bernitz Air-Cooled Floors

Bernitz Super Generator Linings for Water Gas Sets



JEFFREY ENGINEERING *for Material Handling*

COVERS EVERY INDUSTRY

POWER PLANTS

The ultimate cost of coal cannot be determined until the coal is consumed . . . its power utilized . . . and the ash residue disposed of. Handling that coal from mine to track to power plant to ash pile is a major item in that final cost. Over sixty-five years of engineering experience is behind Jeffrey Coal and Ashes Handling Equipment. Whether your plant is small or large, Jeffrey can show you savings with an almost unlimited assortment of Material Handling Machinery.

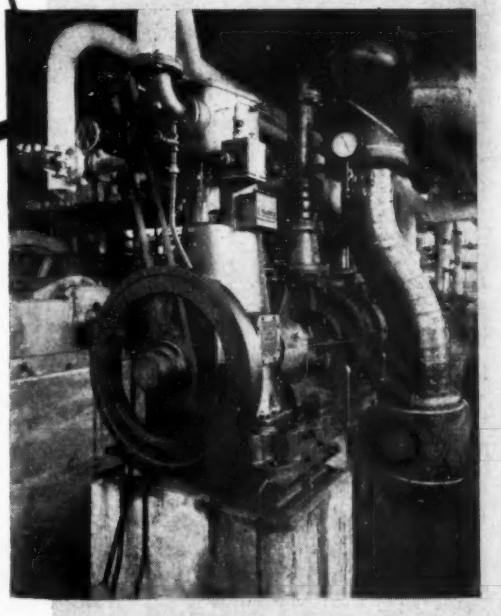
The JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

932-99 North Fourth St., Columbus, 16, Ohio

Baltimore 1, Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 13, Denver 2, Detroit 13, Huntington 19, Huston 6, Milwaukee 11, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 3, Salt Lake City 1, Scranton 3

TROY-ENGBERG POWER



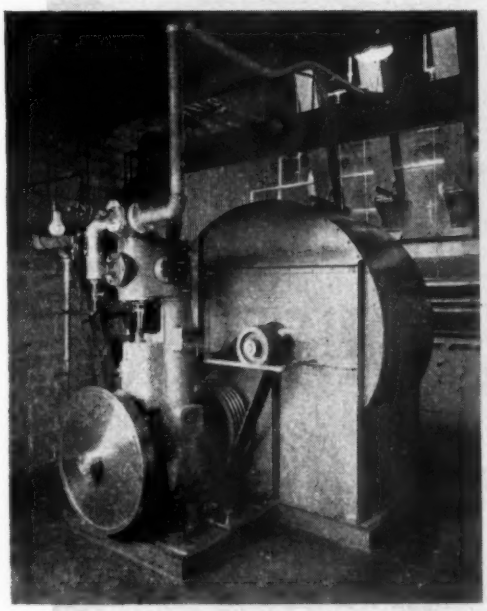
Low Cost because It's

BY-PRODUCT POWER

Some look for certain characteristics in a drive, such as flexibility, or wide speed range, or high starting torque, or sustained overload capacity. But *all* look for the lowest cost consistent with other requirements.

In the Troy-Engberg Steam Engine, you can find all. With the proper heat balance, it will produce power at a lower cost than any other drive.

How about a Troy-Engberg Steam Engine for your plant—to drive that stoker, or compressor, or pump, or fan?



Tell us about the equipment for which you need a drive, the available steam and where you can use the exhaust steam for processing or heating.

Send for our latest catalog.

TROY ENGINE & MACHINE CO.

Established 1870

1499 Railroad Avenue **Troy, Pennsylvania**

2-TEM-2

Packer Saves $250 Per Season on Oil—British Columbia Packers, Ltd, saved more than doubl[e] [o]riginal cost of their Arm[strong] first year they were[n't]

Laundry Model La[undry] six Armstro[ng]

Elimin[ates] Type H two Arm[strong] heater at eliminated to rupture th[e]

Laundry Cuts [Co]st—Peerless Laundries, [Ltd.], one of the world's [la]undries, reduced heating up time by 30 minutes, reduced maintenance cost 8% by installing Armstrong Traps.

Cannery Saves a Boiler—Bestovall Canning Company, Vancouver, B. C., didn't need a new 65 H.P. boiler after installing 7 Armstrong Traps.

Textile Mill Produces Better Yarn—Glenwood Mills, Easley, S. C., installed Armstrong Traps on slasher headers to save steam and gained the added benefit of producing better yarn because the steam to the slashers was dry.

Chemical Plant Saves $2500 on Fuel—Midland Chemical Laboratories reduced fuel oil consumption $2500 annually with 16 Armstrong Traps and found that a new 80 H.P. boiler would handle the load instead of the 125 H.P. boiler that would otherwise have been necessary.

Cuts Coal Bill $650 Annually—A Huntingburg, Ind., firm spent $417 for Armstrong Traps and saved $650 on coal the first year they were installed.

Academy Heats Up Buildings 50% Faster—New York Military Academy buildings are heated in half th[e] formerly required [for] water hamm[er] vegeta[ble] time—[and]

Plating At B[ig] sas[ette] crea[ses] unif[orm] [im]proved [the] ced cos[t]

[Equip] Coal—[Big] ment[s] ong[er] hours, [and] gine [to]

27% Was[hing] N.H[ampshire] fue[l] Ar[my]

uniform p[lating] improved the quan[tity] reduced coal consumption.

Store Equipment Concern Saves 170 Tons Coal—At the Northwestern Store Equipment Corp., Milwaukee, Wis., Armstrong Traps save 170 tons of coal per year; heating-up time on wood drying kilns cut from 5½ hours to 2½ hours, and back pressure on steam engine used to drive line shafting dropped from 7-10 lbs. to 2 lbs.

preciably . . . Steam savings in a large [plant] for traps in [heating] speed [of] Na[tional] gal[lons] in[to] [the] m

e[ach] n's [Co.] ired [in] 0 min[utes] traps.

sumption ity High [pressure] ced per rong

at way[s] re[duced] ngs for fornia nt heats 80°F. to Armstrong duced ap[proximately] s in a large for traps in oking speed cott Co., Na[tional] ks 11,000 gal[lons] ly 20-25 min[utes] derable steam

Cooking Time Reduced—At the *Packing Plant* Bulman's [Restaurant] cut time required o boil from 10 min[utes] Armstrong traps.

s Coal Consumption—[The] ringfield City High School, [Spring]field, Ohio, reduced coal consumption from 8-9 tons per day to 4, by installing 30 Armstrong traps!

Ten Years Without Trap Repairs at Wisconsin Milk Plant—The Galloway-West Condensery, Fond-du-Lac, reports of their Armstrong installation.

How Important are STEAM TRAPS?

. . . judging from the records of Armstrong Steam Trap installations printed on this page, it might seem that no other single item of plant equipment can have such a great effect on fuel consumption, boiler capacity and production rates of steam equipment.

Good traps in good working order pay big dividends!

It follows that efficiency and dependability should be your first considerations in selecting steam traps.

Armstrong offers you an improvement over their *original* inverted bucket design; stainless steel working parts; self scrubbing action; freedom from wiredrawing, sticking or clogging; automatic air elimination and no steam leakage.

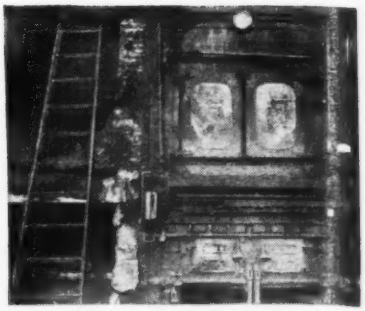
For information on prices, sizes, capacities, physical data, material specifications, installation practice, maintenance and trouble shooting refer to the 36-page ARMSTRONG STEAM TRAP BOOK. Free on request.

ARMSTRONG MACHINE WORKS
812 Maple Street, Three Rivers, Mich.

ARMSTRONG STEAM TRAPS for POWER PROCESS HEATING

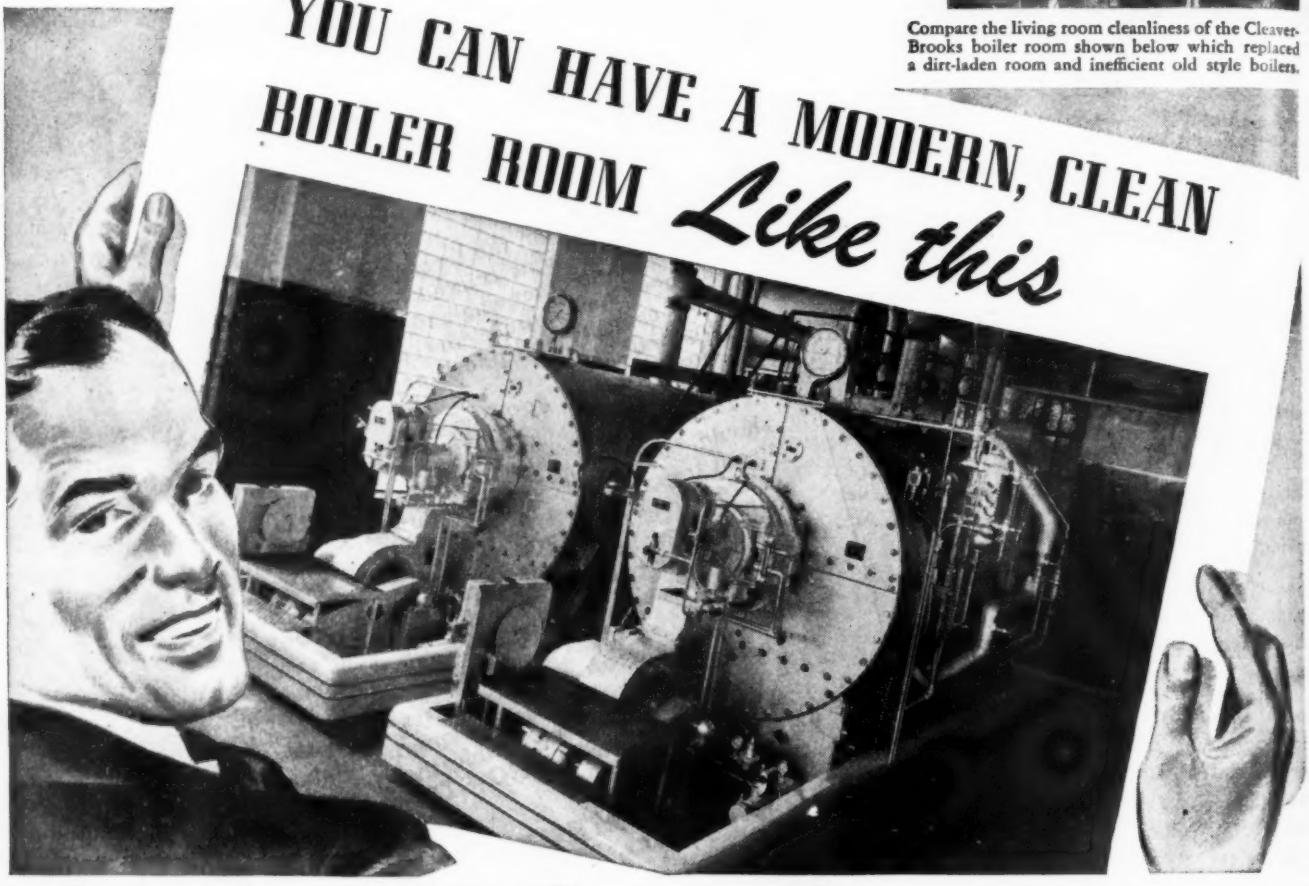
Over a million in use!

PLAN TO REPLACE YOUR OLD PLANT WITH A "PACKAGED" CLEAVER-BROOKS STEAM GENERATOR



Compare the living room cleanliness of the Cleaver-Brooks boiler room shown below which replaced a dirt-laden room and inefficient old style boilers.

YOU CAN HAVE A MODERN, CLEAN BOILER ROOM *Like this*

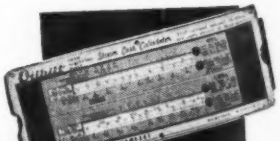


Get these 14 Buyer Benefits . . .

1. **A Steam Generator "Tailored" for *YOUR JOB*** — A Cleaver-Brooks engineer analyses your load conditions, space and machinery arrangements, future growth needs, etc.
2. **Low Operating Costs Through 80% Efficiency** — Lower investment costs and less maintenance requirements.
3. **Quick Steaming Ability** — Through high heat transfer with the Cleaver-Brooks 4-pass, downdraft construction and integral oil burner.
4. **No Special Foundations Needed** — Existing concrete floors will suffice.
5. **No Smoke Stack Required** — A simple roof-high vent carries off all gases of combustion.
6. **Compactness to Save Space** — Uses less plant area, fits into low headroom locations.
7. **Ease of Installation** — Shipped as a complete "package" ready for connection to service outlets.
8. **Factory Tested** — Exhaustive tests are made to insure peak performance in service. Customer may come to see test on his boiler at factory.
9. **Meets all Codes and Specifications**—Designed according to A. S. M. E. Code. Inspected and approved by Hartford Steam Boiler Inspection and Insurance Company. Insurability is guaranteed to standard application buyers.
10. **Centralized Responsibility** — The boiler, integral oil burner and controls are built into one complete assembly by CLEAVER-BROOKS COMPANY.
11. **Customer Service** — A factory engineer puts unit into initial operation, and trains your employees in operation, care and maintenance.
12. **Designed for Utmost Convenience of Operator**—All controls may be operated from front of boiler. All normal maintenance can be done by men without special training.
13. **Living Room Cleanliness**—Oil for fuel insures clean smokeless operation. Boiler room can be made as clean and attractive as the home or office.
14. **Unsurpassed Guarantee**—80% thermal efficiency; 13% CO_2 gases; stack temperatures not to exceed 125°F. above saturated steam temperatures.

Full size range is available — 22 models in sizes from 15 to 500 hp., at steam pressures from 15 to 200 lbs. p.s.i.

In scores of industrial plants, with a wide range of steam needs for power, heat, or processing, Cleaver-Brooks Steam Generators—the product of the pioneer builders of oil-fired "packaged" steam plants — have won the enthusiastic "OK" of satisfied users.



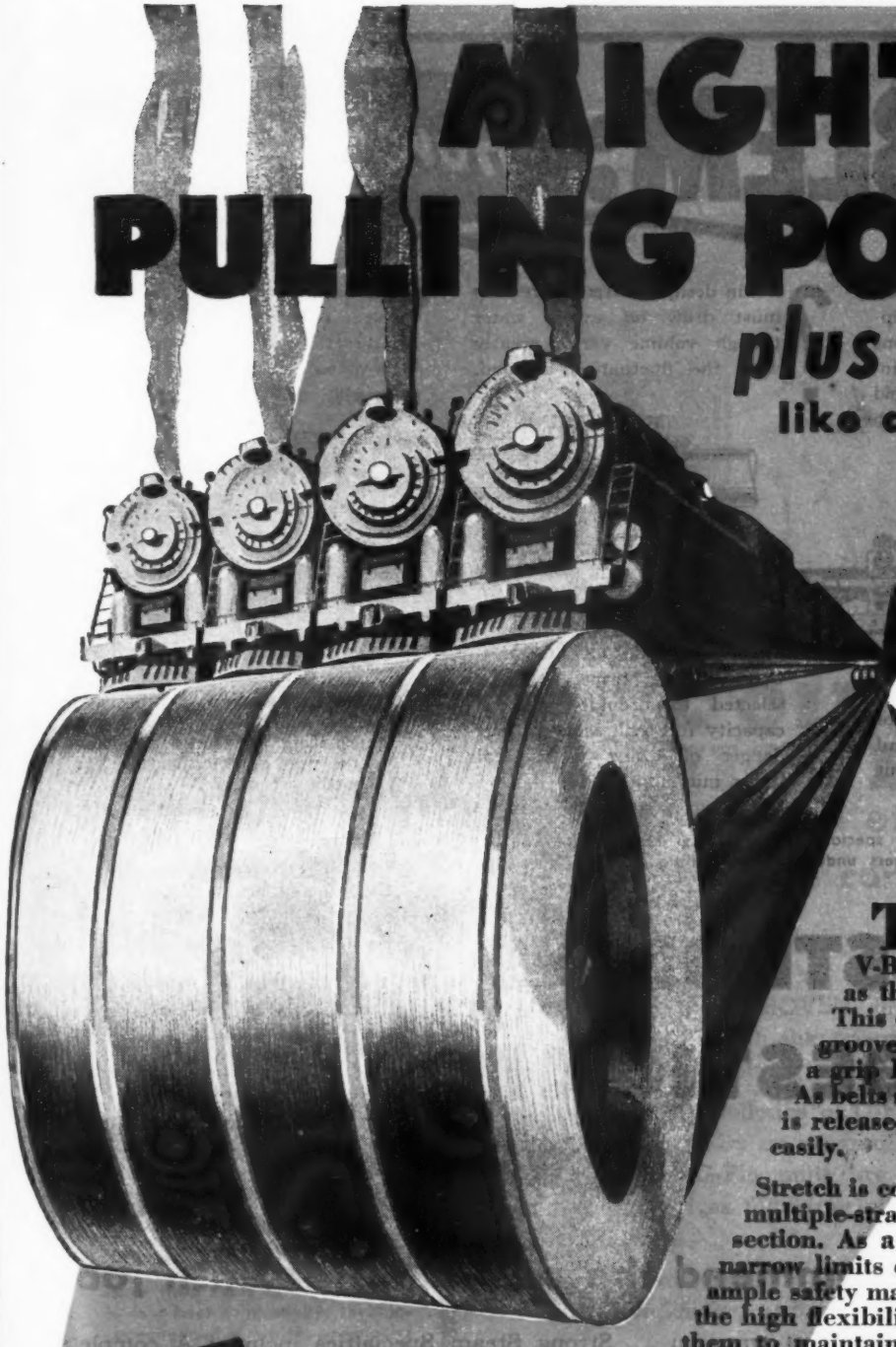
WRITE ON YOUR BUSINESS LETTERHEAD for the *Free* Steam Cost Calculator — a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.

Cleaver-Brooks
STEAM GENERATORS

CLEAVER-BROOKS COMPANY
5109 N. 33rd St.
Milwaukee 9, Wisconsin

MIGHTY PULLING POWER

plus a grip that holds like a friction clutch



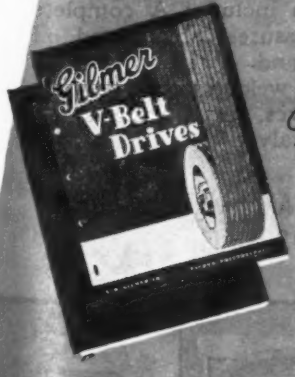
Gilmer BELTS

THE straight sides of Gilmer V-Belts bulge outward instantly as they flex around the sheaves. This exerts a pressure against the groove sidewalls, locking belts with a grip like that of a friction clutch. As belts straighten out, when pressure is released, they unlock smoothly and easily.

Stretch is controlled by pre-testing of the multiple-strand plies in the load-pulling section. As a result, belts operate within narrow limits of elongation, yet provide an ample safety margin of tensile strength. And the high flexibility of Gilmer V-Belts enables them to maintain full contact even on small diameter sheaves and short center drives.

Gilmer V-Belts stand up long in hard, continuous service. Special compounds, developed by Gilmer research, thoroughly bond the pulling cords, keeping them separated and in position, thus eliminating internal friction. Heavy jacketed construction provides adequate protection and strong resistance to wear.

There is a Gilmer V-Belt for every power-transmission need — FHP and multiple, endless and non-endless. And there are sizes to meet all requirements, for Gilmer has the largest assortment of V-moulds in the world.



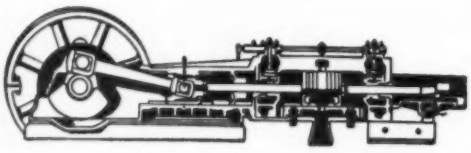
Write for a FREE copy of the Gilmer Guide, the most complete V-Belt catalog in the field. It contains valuable engineering information, standard sheave and belt tables, and other useful data.

L. H. GILMER COMPANY, Tacony, Philadelphia 35, Pa.

DIVISION OF UNITED STATES RUBBER COMPANY

PROBLEM: How would you...

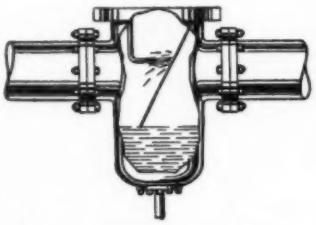
? Drain steam separators *ahead* and oil separators *after* reciprocating engine where pulsations tend to "bounce" buckets of inverted type traps, causing rapid wear, loss of steam and high maintenance.



STEAM ENGINES

Open bucket traps are not affected by pulsations and operate only when sufficient condensate reaches trap.

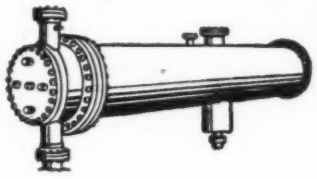
? Drain desuperheater where trap must draw off excess water though volume varies greatly with the fluctuating demand.



DESUPERHEATERS

Open bucket traps may be selected to provide generous capacity for peak load without danger of losing water seal under minimum load.

? Drain heat exchanger using low initial pressures and where throttling by thermostatic control valve causes wide pressure variations.



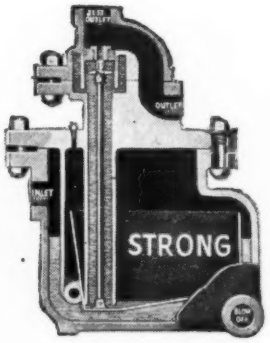
HEAT EXCHANGERS

(Water Heaters, etc.)

Open bucket traps are positive acting under low pressures and fluctuating pressures resulting from use of thermostatic or throttling controls.

NOTE: Inverted bucket traps or special float traps are recommended on desuperheaters and heat exchangers under certain conditions.

HERE'S STRONG'S SUGGESTION



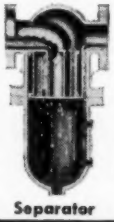
Why we can recommend the best trap for each job!

Conditions may suggest open bucket traps on your job . . . or . . . inverted bucket traps, closed float traps, float and thermostatic traps . . . semi-steel, cast steel, forged or welded construction. To enable you to get the most out of your steam, Strong engineers are at your service with years of experience in all types of installations and a complete line of equipment enabling them to recommend the size and type best suited for your needs.

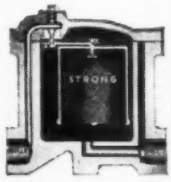
Strong Steam Specialties include: A complete line of traps for all pressures; steam and oil separators in vertical and horizontal types (semi-steel, cast steel or welded construction); pressure regulating valves, strainers, forged steel globe and angle valves, etc. Write for your catalog.

STRONG, CARLISLE & HAMMOND COMPANY
Cleveland 13, Ohio

OTHER STRONG STEAM SPECIALTIES

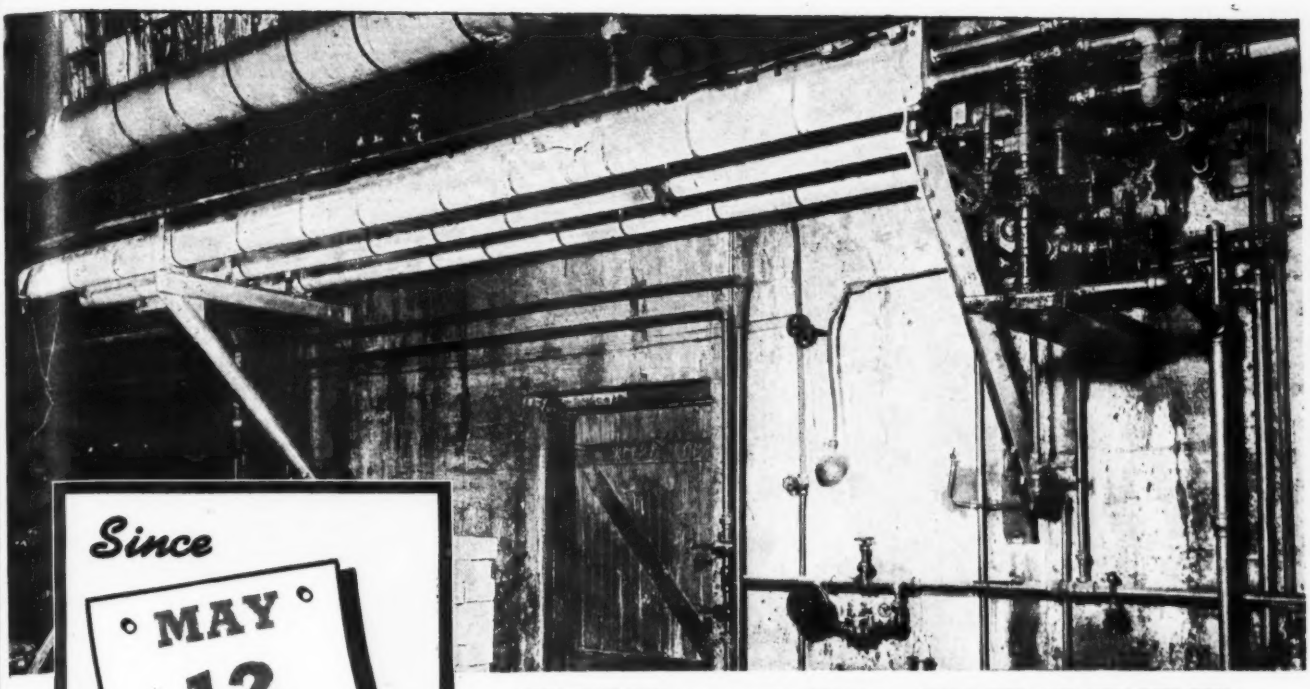


Separator



No. 70—Series Trap

No. 80—Series Trap



Since

° MAY °
12
1933

Another Instance

11 YEARS OF SATISFACTORY SERVICE

The three Twin G-Fin Sections illustrated above were installed as fuel oil heaters in an industrial plant in May 1933, and are still operating with complete satisfaction. Some of the special advantages of Twin G-Fin Sections are their superior effectiveness in transfer of heat to or from fluids of high viscosity or low heat conductivity, their interchangeability which promotes flexible capacity, and their compactness and lightness which assists ease of handling and erection.

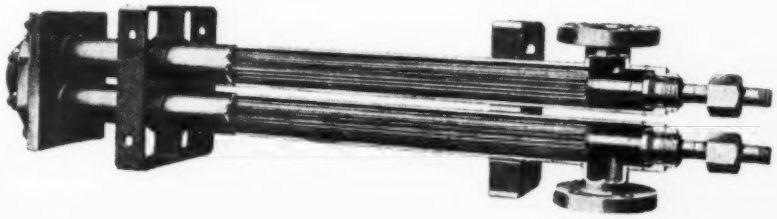
FUEL OIL HEATER SERVICE RECORDS

prove the excellence of G-FIN construction

G-Fin . . . the extended heat transfer surface with longitudinal fins originated by Griscom-Russell more than 12 years ago . . . has PROVEN its durability, as well as its effectiveness, through the operating records of more than 40,000 installed units in which G-Fin elements are used.

Moreover, the excellence of G-Fin design and construction is further proven by an unequalled range of successful applications, for G-Fin units are being used on a greater variety of services than any other heat transfer apparatus on the market.

Be sure to investigate a G-Fin Unit for your next heating, cooling, condensing or heat transfer requirement.



THE GRISCOM-RUSSELL CO.
285 Madison Avenue
New York 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

HERE'S THE "Tiffany" OF High TEMPERATURE – High PRESSURE PACKING

Core: Vulcanized pure asbestos fibers, thoroughly graphitized.

Braided Asbestos Jacket: reinforced with monel wire.

JOHN CRANE Style 6-AM

Large steel plant, Youngstown, Ohio:

"6-AM installed in open hearth valves. No difficulty."

Cleveland steel mill:

"Open hearth valves still packed after 9 months. Exceptional service."

Large high-pressure power plant, Painsville, Ohio:

"Excellent service with steam on stop valves at 2000 p.s.i., 650° F. and superheated 300°. Have standardized on 6-AM."

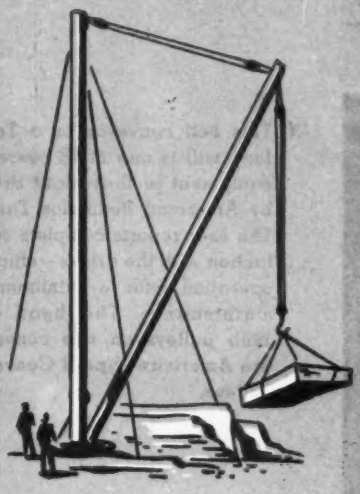
Operating Engineers: Order spirals, coils, spools, die-formed rings or sets.

CRANE PACKING COMPANY

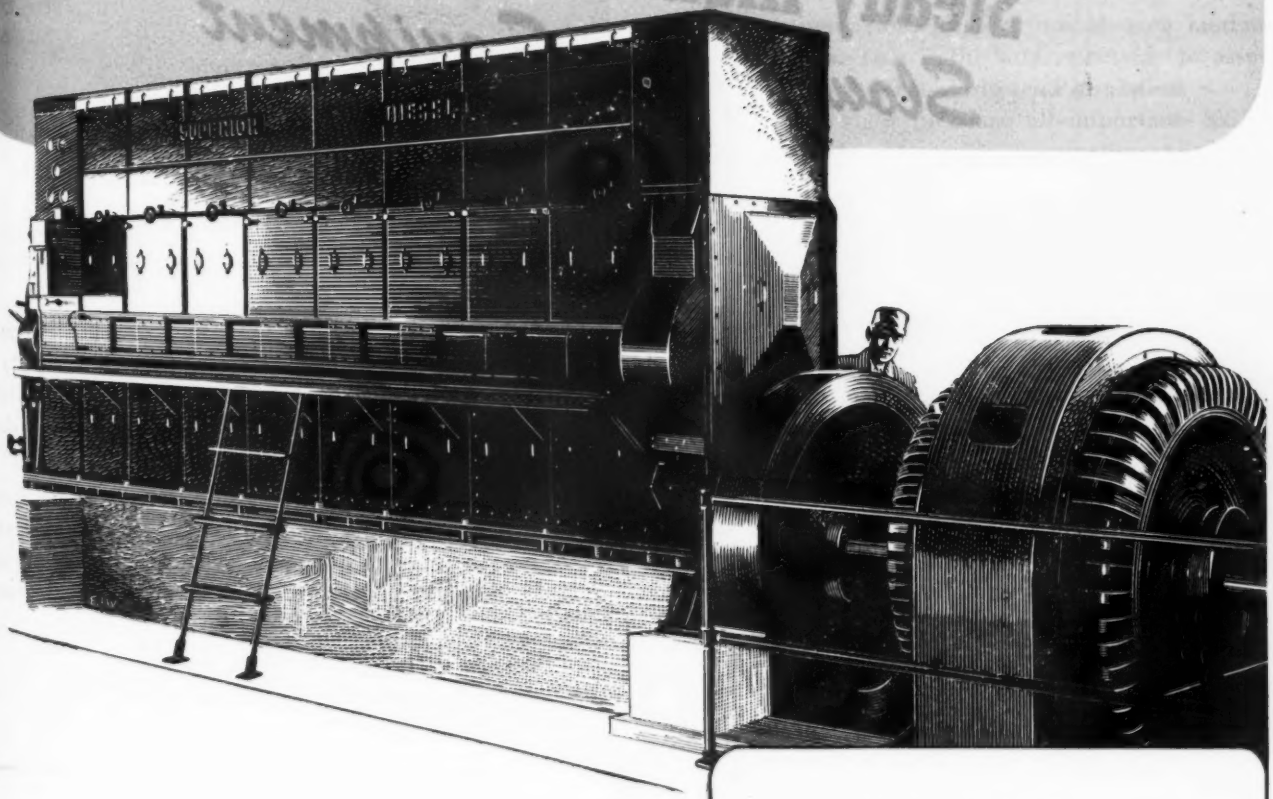
1811 CUYLER AVE. • CHICAGO 13, ILL.

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada
Branches: Montreal, Toronto, Vancouver



Industry can Trust the Time Honored Dependability of *Superior* Diesel



SUPERIOR DIESELS • STATIONARY, 28 to 1325 H. P.
MARINE, 28 to 1325 H. P. • GENERATOR SETS, 20 to 928 kw.

Superior **ENGINES**
Division of
THE NATIONAL SUPPLY CO.
General Sales Office:
Springfield, Ohio

This belt conveyor in a Texas feed mill is one of 18 pieces of equipment in that plant driven by American Reduction Drives. The user reports complete satisfaction with the drives—efficient operation with a minimum of maintenance. The head and snub pulleys on this conveyor are American Type N Conveyor Pulleys.

Steady High Production from *Slow Speed Equipment*

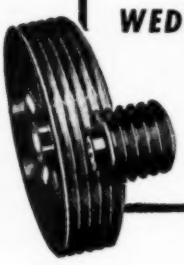
Less time out for maintenance and assurance of proper speed pay off heavily in increased production when slow-speed machinery is equipped with American Reduction Drives. On such installations, the primary belt drives do the high-speed work and cushion the heavy impacts of starting and shock loads easing the strain on motors, bearings and gears. Maintenance is reduced to only periodic lubrication.

American Reduction Drives, with standard 13 to 1 ratio Reduction Units, deliver any required output speed from 11 to 154 rpm. by simply selecting the proper ratio American V-belt or Flat-belt primary drives. And six standard sizes will handle jobs from 1/4 to 25 hp.

A further advantage is their space-saving feature and low installed cost. The unit mounts directly on the shaft of the driven machine, just like a pulley and no costly drive supports or special foundations are needed.

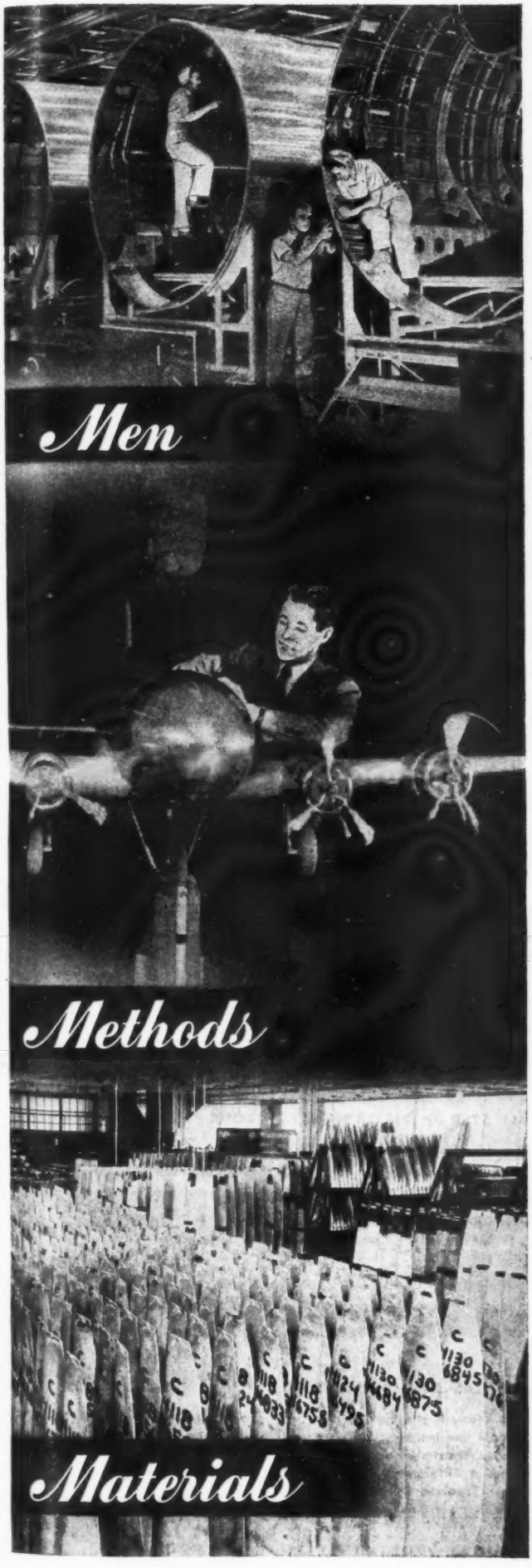
Write for American Reduction Drives Handbook. Complete engineering data and drive selection tables make it easy to specify and install American Reduction Drives to meet your specific requirements.

The American Pulley Company
4226 WISSAHICKON AVE., PHILA., PA.



WEDGBELT SHEAVES

American Wedgbelt Sheaves are made to highest precision standards of sound, strong materials. Accurately machined, carefully balanced, they assure true-running performance.



PLANE PRODUCTION THAT AMAZED THE WORLD

96,369 precision-built planes rolled off American production lines in 1944. A record our enemies said couldn't be achieved! Yet American workmen (and women, too), American planning, plus a wealth of the proper materials, all combine to send out the greatest air armada the world has ever seen. *Men, Methods* and *Materials*... the combination that means final victory!

GET ALL 3 WHEN YOU INSULATE!

All the elements *properly coordinated*—men, methods and materials. This is the RUBEROID way to assure maximum service from industrial insulation.

MEN... The right men are all-important. Skilled mechanics in the nationwide organization of Ruberoid Approved Applicators handle the jobs. These men know their business. They've licked the most difficult insulation problems.

METHODS... Each installation is "tailor-made" to meet the individual job. Ruberoid engineers are not wedded to any one method. You get the benefit of broad experience with all possible methods of application.

MATERIALS... The right insulation material to meet your specific temperature control problem. The Ruberoid insulation line has no "gaps" in it from 0° to 1900° F.

RUBEROID
INSULATION
A complete service

Write for Ruberoid Insulation Guide and technical data.

The RUBEROID Co., *Executive Offices*, 500 Fifth Ave., New York 18, N.Y.

ASPHALT AND ASBESTOS BUILDING MATERIALS

IT WAS ABOUT TIME for someone to design a better zeolite softener!

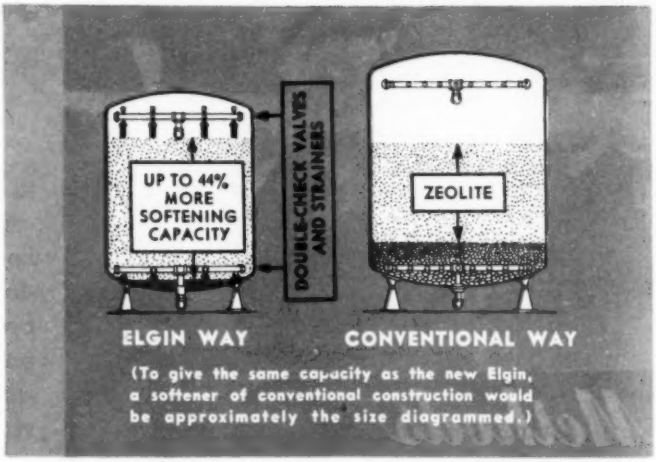
ELGIN DID IT . . . with the "DOUBLE-CHECK" DESIGN

UP TO 44% MORE SOFT WATER

UNTIL the new Elgin water softener was developed, zeolite softener design had simply gone along the beaten path. One simple, but very basic change—the Elgin "Double-Check" manifold—marked the turn onto a new road. Up to 44% more soft water . . . prevention of zeolite loss . . . better backwashing . . . lower salt consumption . . . these are the accomplishments of the new Elgin softener, fully confirmed by a long list of users.

The reason for this is clear cut: The "Double-Check" arrangement permits placing far more zeolite in a softener of given size and prevents escape of zeolite. More zeolite means more soft water output. The manifold design also permits better backwashing and prevents packing and channeling. As a result, the brine reaches every portion of the zeolite, giving complete, efficient regeneration with less salt consumption.

The diagram tells the story. A softener of conventional design would have to be as much larger as shown to give equal soft water output, and of course its operating and maintenance cost would also be proportionally greater. *For the story of the new Elgin write for Bulletin 603.*


UP TO 44% MORE SOFTENING CAPACITY
DOUBLE-CHECK VALVES AND STRAINERS
ZEOLITE
ELGIN WAY
CONVENTIONAL WAY
(To give the same capacity as the new Elgin, a softener of conventional construction would be approximately the size diagrammed.)

YOU CAN STEP UP THE CAPACITY OF YOUR PRESENT SOFTENER

The "Double-Check" principle is adaptable to your present softener regardless of make. This change, along with Elgin High Capacity Zeolite, will give you greatly increased soft water output at surprisingly low cost. Ask for facts.

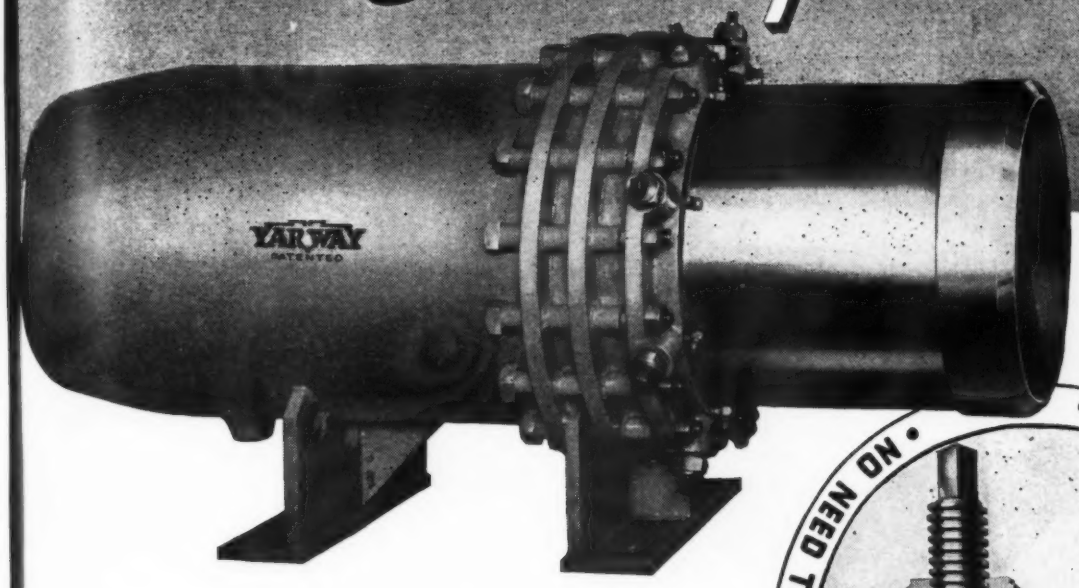
ELGIN
ECONOMICAL WATER CONDITIONING

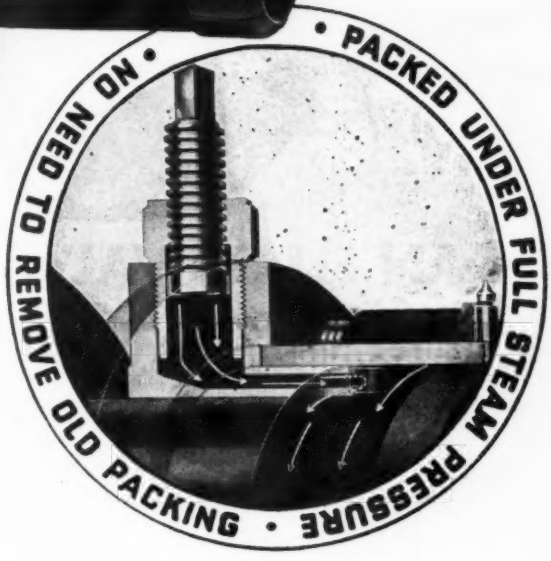
ELGIN HAS THE ANSWER—

Elgin is known for achieving results at lowest possible cost. The complete Elgin line includes: Boiler Water Treating and Purifying Systems • Feedwater Treatment • Deconcentrators • Heat Exchangers • Water Softeners • Filters and Purifiers • Iron Removal Equipment • Aerators • Water Treating Chemicals • Chemical Feeders • Scale and Corrosion Inhibitors • Sample Coolers • Water Testing Equipment • Zeolites

ELGIN SOFTENER CORPORATION, 130 NORTH GROVE AVE., ELGIN, ILLINOIS

Never Unpacked in Eight Years of Service





Years of experience with thousands of Yarway Gun-Pakt Expansion Joints have established the Yarway as the preference of leading industrials, utilities, institutions and government departments.

For they all have learned that this joint which is packed under full steam pressure and never needs to be unpacked—eliminates repacking shut-downs, saves a tremendous amount of time, trouble, money and hard labor under gruelling temperature conditions, normally required to keep slip-joints tight.

Why don't you investigate the Yarway Gun-Pakt Joint—called "the greatest expansion joint improvement of modern times."

Write for Catalog EJ-1909.

YARNALL-WARING COMPANY
100 Mermaid Ave. Phila. 18, Pa.

The Yarway Gun-Pakt Expansion Joint is the ONLY slip Joint which is packed without unpacking. By a twist of a wrench, a special Yarway semi-plastic packing is forced into the stuffing box by means of integral pressure guns while the joint is under *full steam pressure*. The old packing, rejuvenated by the new, need not be removed.

YARWAY GUN-PAKT EXPANSION JOINT

HEALEY BUILDING

HEALEY
REAL ESTATE AND IMPROVEMENT CO.
OWNERS AND OPERATORS
HEALEY BUILDING and WILLIAM-OLIVER BUILDING
OFFICE OF THE MANAGEMENT: HEALEY BUILDING
ATLANTA 3, GA.

February 28, 1944

Sloan Valve Company
4300 West Lake Street
Chicago, Illinois

Dear Sirs:

We have had Sloan valves in the Healey Building over a period of some thirty years, and have found them thoroughly satisfactory. Moreover, in our other office building, the William-Oliver Building, completed in the fall of 1930, Sloan valves were installed and have given excellent service since that time.

It is our opinion, in view of our experience, that Sloan valves are outstanding equipment in their line.

Yours very truly,
HEALEY REAL ESTATE & IMPROVEMENT CO.

WTH:LC

By: William T. Healey, Jr.
William T. Healey, Secy.

SLOAN FLUSH VALVES

"EXCELLENT SERVICE FOR THIRTY YEARS"

Mr. Healey, like all good building owners and managers, buys and installs mechanical equipment with an eye to the future. It is the year-by-year economy, the long range durability that is of vital concern to the man who pays the bills. Hence: Sloan Flush Valves.

Hundreds of thousands of Sloan Flush Valves have been giving trouble-free service for many, many years. Small wonder there are more Sloan Flush Valves sold than all other makes combined. And remember: when priorities relax and building is resumed, the postwar Sloan Flush Valve will be better than ever before.

Plan wisely on Sloan's *unequalled* record of performance by specifying Sloan Flush Valves for *your* postwar building.

Sloan Valve Company has been awarded the Army-Navy "E" three times for excellence in production.

SLOAN VALVE COMPANY, 4300 WEST LAKE STREET, CHICAGO 24

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Condenser Tubes Severely Taxed

Overwork and Unavoidable Neglect Can Be Offset by More Corrosion Resisting Alloys

Recent personal interviews with a considerable number of power plant engineers in various parts of the country indicate that today's job of supplying electricity, especially in industrial sections occupied with war work, is as big as ever. All available equipment has been put into service. The engineer's job is much more difficult than in peacetime because of long hours and a critical labor shortage. In some cases, this means reduced maintenance of condensers resulting in less efficiency and shorter tube life. More corrosion resisting condenser tubes are needed that can stand up under unavoidable neglect and overwork.

Test Lots Indicate Best Alloy

In many places such as seaboard locations especially in harbors and bays, the circulating sea water is badly contaminated with sewage and factory wastes. In some cases, Admiralty condenser tubes last only two years. DURONZE IV is recommended here and should be given at least a trial as soon as possible.

Engineers planning for future expansion when new equipment will be available, are in some instances putting in test lots of several different condenser tube alloys for periodic observation in order to determine definitely which alloy will serve best. Bridgeport's Laboratory will be glad to cooperate with any forward looking engineers who really want to know what's best under existing operating conditions.

Periodic Examination Important

An engineer should periodically examine his condenser tubes to prevent premature failure due to conditions that are avoidable. For example, in the case of several condenser installations using the same water supply, the condenser nearest the source was being affected by impingement corrosion much more than those farther away. Examination of the one which was giving the most trouble showed the presence of shells and debris which had blocked many of the tubes and had greatly increased the rate of water velocity in the tubes which were not covered. The exposed tubes were failing rapidly. Frequent cleaning and proper maintenance of the screen could have prevented the entrance of the greater portion of the objectionable material and prevented the blocking of the condenser.

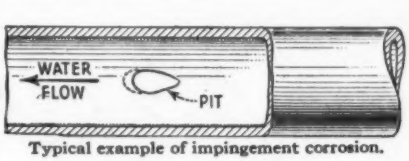
Fighting Impingement Corrosion

In another station excessive impingement corrosion of Admiralty was laid to high velocity and entrained air. If careful checkup of pump glands and system to eliminate air is not effective, it is necessary to use alloys such as CUZINAL or DURONZE IV that are more resistant to impingement corrosion.

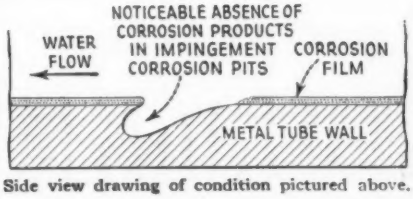
A visit to a chemical plant revealed that steel tubes conveying amine solutions were corroding badly on the outside by circulating sea water. Here is an instance where Duplex tubing—steel on the inside and Admiralty outside—would solve a bad situation.

Bridgeport offers a number of modern corrosion-resisting condenser tube alloys which are designed to stand up under severe conditions of operation existing during wartime. Our laboratory services are available to help select the alloys which will give the best service.

If you do not have a copy of Bridgeport's Condenser Tube Manual, write for it today on company stationery.



Typical example of impingement corrosion.



Side view drawing of condition pictured above.

Revised Duronze Manual Features Product Improvement

Bridgeport Brass Company has recently published a revised edition of their 80-page DURONZE Manual. It contains specifications and technical data on five copper-base engineering alloys in the form of sheet, rod, wire and tubing. Many applications are suggested for the manufacture of strong, wear and corrosion resisting parts by hot forging, cold forging and machining.

Outstanding is DURONZE III, an Aluminum Bronze modified by silicon, which is approximately 50% stronger than brass, 9% lighter in weight, and has exceptional resistance to corrosion from sea water. Because of its low coefficient of friction when in moving contact with steel and most other materials, it is excellent for valve stems for steam valves, pump parts, marine hardware, etc. This alloy is free machining.

DURONZE III hot forgings, approximately twice the strength of brass forgings, are replacing gears, valve stems, seats and bushings, rollers, and similar items made from steel or cast bronze. It is also used for

outdoor electrical equipment, wire and cable connectors and other parts which must withstand exposure, weathering, smoke and dirt. Because DURONZE III is approximately 50% stronger (in the annealed condition) than Naval Brass, and 9% lighter in weight, 40% to 50% in dead weight can be saved without any sacrifice in yield and tensile strengths by using DURONZE III instead of Naval Brass. This weight and space saving can be utilized on shipboard, for example, to carry a paying load.

Write today on company stationery for your free copy of the DURONZE Manual.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN.

ARMY E NAVY

ESTABLISHED 1865

Union HB Offset Sidebar Roller Chain is manufactured in a complete range of strengths and in sizes from 1½" to 6" pitch. Recommended for heavy duty drives.

Heavyweight Champion

☆ Built for the toughest tasks of power transmission, Union HB (hardened bearing) Offset Sidebar Roller Chain can rightfully be called a heavyweight champion. This is just one of many types of Drive and Conveying Chain made by Union in addition to complete lines of Finished Steel Roller Chain, Silent Chain and Flexible Couplings.

The Union Chain Organization is composed entirely of chain specialists. Inasmuch as Union does not manufacture machinery of any kind, undivided attention is given to the making of a complete line of chain and sprockets which have a reputation with customers for "wearing well." Be sure that you have all three Union Chain Catalogs in your files. For your next chain requirement... buy Union.

The Union Chain and Manufacturing Company ..... Sandusky, Ohio, U. S. A.

Catalog A-2 covers Drive and Conveying Chain. B-2 covers Finished Steel Roller Chain. FC-1 covers Flexible Couplings. Ask for your copies.

Union Chains for Every Application

Drive and Conveying Chains and Sprockets
- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

★

Finished Steel Roller Chains and Sprockets
- All manufacturer's standard, size ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

★

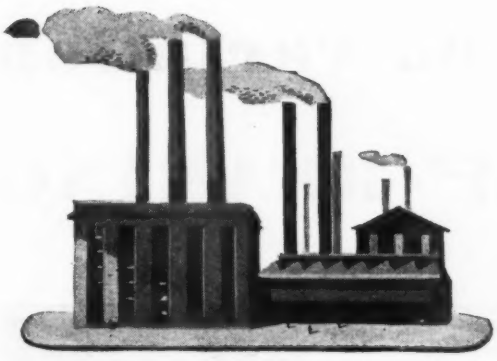
Silent Chain and Sprockets
- All sizes ⅜ in. to 1½ in. pitch

★

Flexible Couplings
- Roller chain type
- Silent chain type

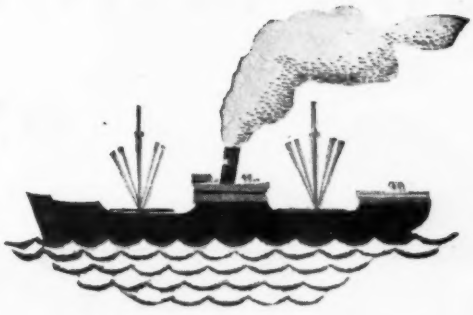
ARMY E NAVY

UNION CHAINS



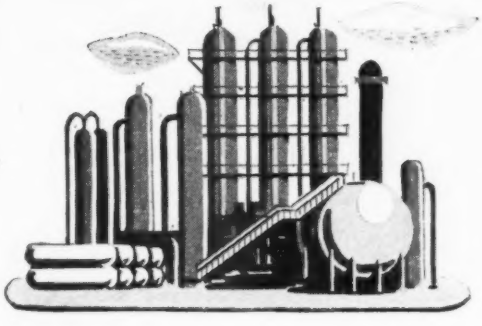
CURED BY A NOSE FOR TROUBLE

Consistent failure . . . at the same definitely-located points . . . led this power plant to apply to Scovill for help. Scovill *Service in Men* helped determine that chlorine leakage was causing the trouble. A few simple installation changes cured the trouble.



DOUBLE RIDE WITH CUPRO-NICKEL

Admiralty tubes operating in 210°F., vapor-side, lasted only 8 months. Contaminated salt to brackish circulating water invited permeable scale formation, favoring dezincification. Scovill *Service in Metals* recommended 70-30 Cupro-Nickel, lengthening service life 100%.



CONCERNING AN INFORMATION EXCHANGER

Many a refinery man, reading Scovill's Condenser Tube Booklet, has widened his knowledge of certain phases of heat exchanger tube service. Scovill *Service in Manuals* reports regularly on studies of Scovill research laboratories plus experiences of Scovill service engineers.

All three types of problems...selection of the proper metal...correct installation practice... desire for further information—are directed to Scovill because it is

One Company Which Gives You

ONE PRODUCT

. . . Condenser Tubes

THREE SERVICES

For a free copy of the new Scovill Condenser Tube Booklet, write SCOVILL MANUFACTURING CO., 13 Mill St., Waterbury 91, Conn.

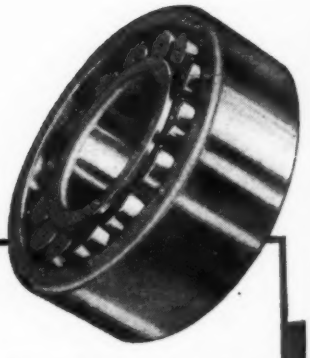
1200 to 300 r.p.m. variation

ON SKF BEARINGS

● *Built by* STERLING ELECTRIC MOTORS, INC.

It's all in the day's work for SKF Ball Bearings to insure smooth, easy performance of vital rotating parts on this rugged, compact 5 h.p. Sterling Speed-Trol Motor . . . to provide full load carrying capacity . . . to assure the ready command of any r.p.m. from 1200 to 300 r.p.m. variation. Day after day, month after month, year after year, SKF's in this way help *increase* production, *decrease* production costs, improve products. Wherever there's an SKF, the right bearing is in the right place . . . always. 5755

SKF INDUSTRIES, INC., PHILADELPHIA 34, PA.



Pioneering in practically all industries, SKF produces ball and roller bearings of all types and sizes, from ⅛" to 59" O.D.

SKF
PUTS THE RIGHT BEARING IN THE RIGHT PLACE

SKF
BALL AND ROLLER BEARINGS

TOLD IN WORDS OF USERS

"BETTER CONTROL"

"These valves give us better control over a longer period and really hold the pressure. It is our opinion that this is the finest control valve on the market. We shall reorder as the occasion develops."

"WELL PLEASED"

"We are well pleased with the streamlined regulator. Its operation is so good we don't know we have it in the plant. When we need another regulator we'll buy a streamlined one."

"Holds Steady Delivery Pressure"

"We like the Streamliner for its high capacity (we have used it on CO_2 and air). Other valves have so many twists and turns that they have a high pressure drop. On our CO_2 job we were unable to get the required capacity 'til we tried the Streamliner."

"LARGE CAPACITY"

"We like the '1000' valve very much due to its large capacity and perfect holding of reduced pressure right at point valve is set to deliver."

"Plenty of Closing Power"

"We needed a valve with plenty of closing power for use on dirty steam. Your large diaphragm valve gives tremendous closing power. The valve is easy to clean. The service has been very good."

"DEPENDABLE"

"This valve is the most dependable of any regulators we have ever used. Why, about two years ago I had a rush steam reduction job and had no valve for this spot. I had a 1000 air regulator with composition seat and rubber diaphragm that I put in. It's been in ever since and doing a swell job."

"FREEDOM OF FLOW"

"I bought this valve because I liked the freedom of flow and its being able to pass off scale and dirt. Keeping this off the diaphragm, I could see how the valve would always be very sensitive. It has been proven to me just what it will do and I am sold. When you set them they sure do stay."

CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000

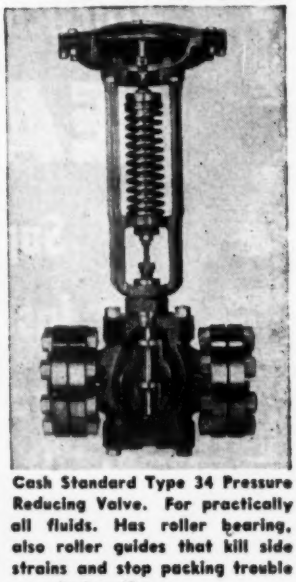
Type 1000-HP normal size diaphragm. Made for delivery pressures over 30 lbs.

Type 1000-LP has large diaphragm. Made for delivery pressures under 30 lbs.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

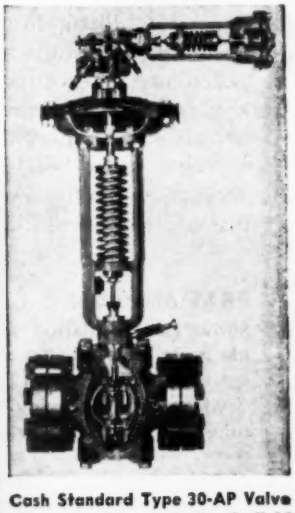
OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 34 Pressure Reducing Valve. For practically all fluids. Has roller bearing, also roller guides that kill side strains and stop packing trouble —no lost motion.

Sizes: ½" to 12" inclusive. Highest initial pressure 800 lbs.; reduced pressure vacuum to 150 lbs. Bodies: iron, bronze, steel. Trim: iron, bronze, stainless steel. Ends: screwed, flanged, ammonia type, welding type. Bulletin 968.

☆



Cash Standard Type 30-AP Valve gives precise control of fluid pressures, through a pilot connected to the pressure under control. For steam, water, air, and most fluids.

Can be a pressure reducing valve or a back pressure valve depending on the way the control lines are connected. Pressures up to 600 lbs. Sizes ½" to 12" screwed; 1" to 12" flanged ends; wide variety of metals.

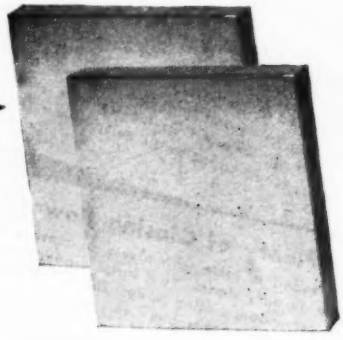
☆

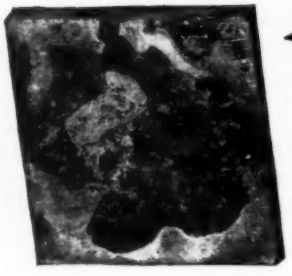
FACTS YOU MAY NOT KNOW ABOUT EAGLE MINERAL WOOL INSULATION

Practical test* proves EAGLE Super "66" Insulation is non-corrosive—in fact, it is actually rust-inhibitive

* **AS THEY WERE**

Here's a photograph of two steel blocks before being used to test the anti-rust properties of Eagle Super "66" in the Eagle-Picher laboratory. Note unblemished surfaces. Then study accompanying photos.



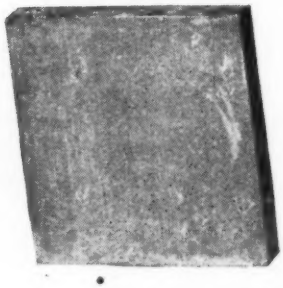


AS ONE BECAME

How one of the steel blocks looked after being imbedded in a regular insulating cement for the test period. Note the extent of the rust. Such corrosion also occurs on iron and steel equipment whether heated or cold.

AS ONE REMAINED

Imbedded in Eagle Super "66" for the same test period, this block shows how effectively the rust-inhibitive and non-corrosive properties of Eagle Super "66" protect your heated equipment.



The above test will readily suggest to you the *protection* Eagle Super "66" Plastic Insulation can give your costly and perhaps irreplaceable heated equipment—quite apart from the sweeping savings on fuel which it affords!

Springy Ball Structure

Eagle High Temperature Mineral Wool is nodulated into pellets, or "springy balls," each of which contains thousands of tiny dead air cells which impart high thermal resistance. Pellets keep their dead air cell structure after application. Eagle Super "66" Plastic Insulation forms an efficient monolithic coating without cracks or joints . . . is designed to serve up to 1800° F. . . . is reclaimable and reusable when not subjected to temperatures exceeding 1200° F.

With Super "66" we recommend Eagle INSULSEAL, a fire-resistant, protective coating that safeguards insulation from damage.

FREE *Manual!*

Shows how insulation on a single Boiler Shell can save you as much as $1,500 a year in fuel costs.

Write for your copy of this timely booklet on how *you* can conserve industrial heat and power with mineral wool insulation.

EAGLE-PICHER HIGH TEMPERATURE INSULATIONS

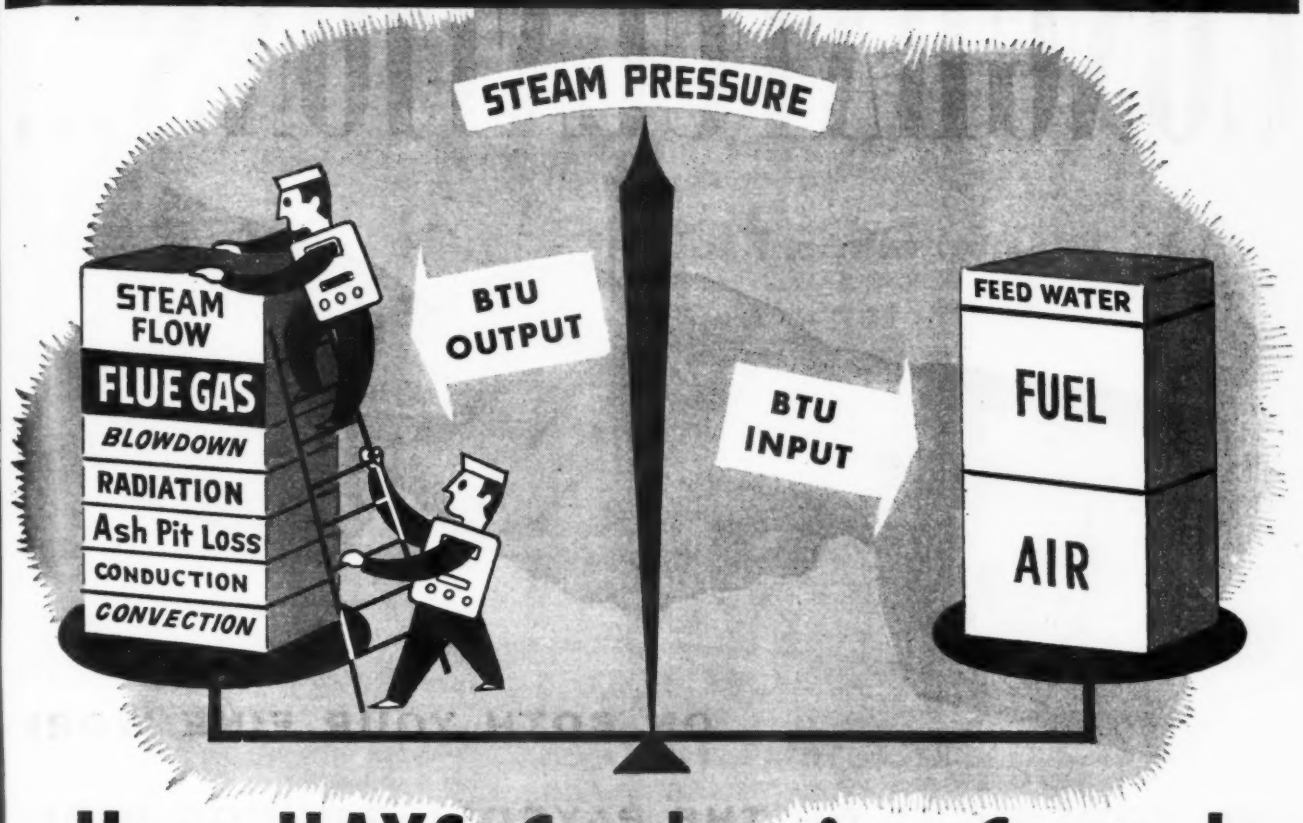
Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE EP PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY, Cincinnati, Ohio

ELECTRICAL OPERATION IS AS MODERN AS POST WAR INDUSTRY MUST BE!



How HAYS Combustion Control balances heat in-put and out-put

...You SEE the 12 Vital Points of Modern Combustion Control in Hays Sales Visual

The most comprehensive, most understandable explanation of automatic combustion control ever compiled. Ask the Hays representative to show it to you.

1. The purpose of Combustion Control.
2. How that Purpose is accomplished—3 methods of control.
3. What results can be expected of each.
4. Elements of a *good* control system.
5. Elements of a good controller
6. *Coordinating* the controllers.
7. Selecting the best system for your needs.
8. How Automatic Combustion Control operates.
9. How each individual controller operates.
10. How controllers are calibrated and adjusted to fit requirements.
11. How controllers are stabilized to prevent hunting or over-travel.
12. Typical installations of Automatic Combustion Control.

HERE IS METERING CONTROL reduced to its simplest, most effective terms:

- A master steam pressure controller responds to changes in steam pressure and adjusts air and fuel controllers
- Air and fuel feed controllers, operated by accurate impulses from the master controller, supply the correct amount of air and fuel to maintain the steam pressure constant
- A furnace draft controller operates to hold furnace draft constant

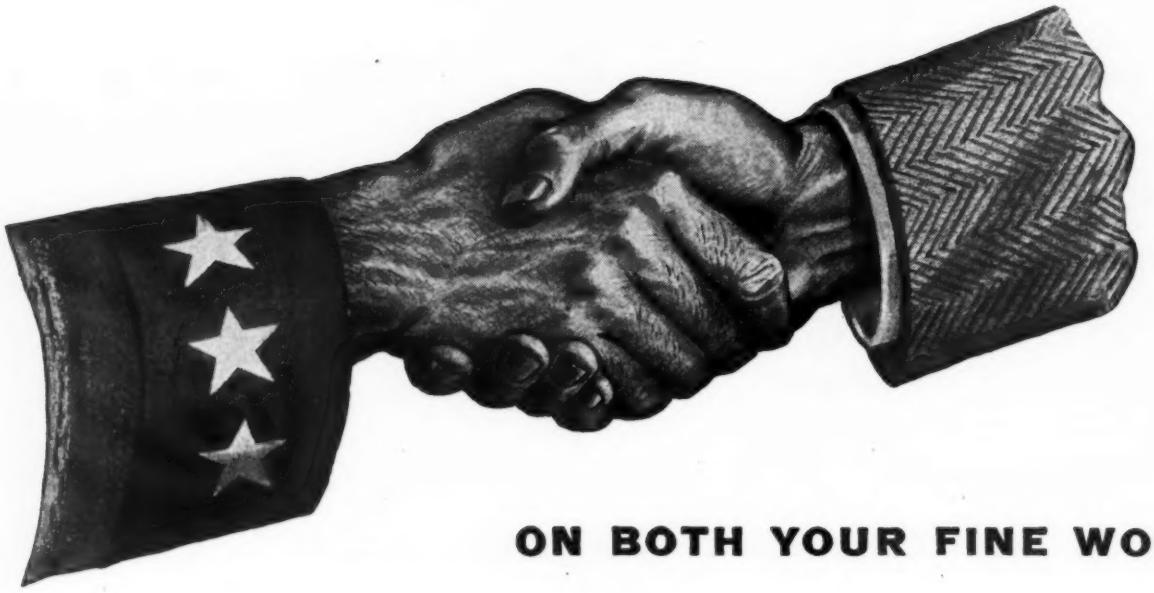
These control units measure every slight variation in every combustion factor—and instantly adjust them ***in a precisely coordinated pattern.*** Impulses to all actuating devices are instantaneous—***because they are electrical.***

There you have it.

How that system will benefit your business—by vital savings in man-hours and steam costs—can easily be learned by consulting with Hays engineers. As a practical first step, arrange to see the Hays Visual Explanation of Automatic Combustion Control—worth seeing. Write us about it.

The HAYS CORPORATION
SINCE 1907
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

CONGRATULATIONS...



ON BOTH YOUR FINE WORK AND FORESIGHT ON THE PAYROLL SAVINGS PLAN!

IN your wholehearted support of the Payroll Savings Plan, you are doing far more than backing the most valid system of war financing—and building a powerful dam against the onrush of dangerous inflationary dollars.

By encouraging the all-out participation of your employees in this greatest of all savings plans, you are helping to create a sound economy for post war days.

With this same plan, you are assisting working America to build a mainstay against the inroads of unemployment and want—to save for homes, educational advantages and old age comforts!

You and your employees, through *mutual* cooperation in this forward-looking plan, are gaining a new and closer understanding—the cornerstone of a firmer, *mutually* profitable relationship!

National benefits, too, follow the "All Out" effort you are making! The prosperity of our United States rests on the economic stability of both management and labor. Your Payroll Savings Plan is working constructively toward the assurance of both!

The Treasury Department acknowledges with appreciation the publication of this message by

POWER

★ *This is an official U. S. Treasury advertisement prepared under the auspices of Treasury Department and War Advertising Council* ★

REMEMBER ROCKBESTOS A.V.C.

For Those Hot-Spot Installations You'd Like to Forget

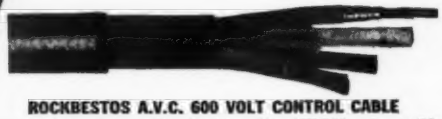
ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA)

This cable and Rockbestos A.V.C. Motor Lead Cable have a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

1. A tough rugged asbestos braid, resistant to heat, flame, moisture, oil, grease or corrosive fumes.
2. Outer felted asbestos wall, impregnated with heat, flame, and moisture resistant compounds, serves as an effectiv barrier against high ambient temperatures and flame.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.
4. Felted asbestos insulation, also impregnated with heat, flame and moisture resisting compounds, withstands conductor-heating overloads and won't dry out, bake brittle, flow or burn.
5. The conductor is perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

WON'T bake brittle, bloom, burn or rot.
RESISTS moisture, oil, grease and fumes.



ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors. Standard stranding AWG No. 12—19/No. 25 and No. 9—19/No. 22. Other sizes and strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

THERMOSTAT CONTROL WIRE — TABLE TC

Sizes No. 14, 16 and 18 AWG in two to six conductors with 12½, 25 or 31 mil wall of felted asbestos insulation and cadmium plated steel armor.

A multi-conductor control wire for low voltage intercommunicating, signal and temperature control systems. Its life time insulation and rugged steel armor will give you troubleproof circuits.

The way to wipe out wire-worries is to install Rockbestos A.V.C. in all those hot-spots that are likely to cause trouble . . . soaking pits, forging presses, steam tunnels, lehrs, kilns, furnaces, boiler rooms, etc. With Rockbestos A.V.C. circuits you can depend on trouble-free service year after year, thus saving the time and money required by frequent rewiring jobs.

Rockbestos A.V.C. has a *permanent impregnated asbestos insulation* which stands up in operating temperatures up to 230° F. without baking or cracking. It resists heat, flame, oil, grease, moisture and corrosive fumes . . . won't bloom, flow, swell or rot under exposure to severe heat and vibration.

Rockbestos A.V.C. is available in many standard constructions for service requirements ranging from 600 to 5000 volts. When ordering or inquiring, please furnish CMP allotment symbol and certification. For complete information and samples, write nearest branch office or:

Rockbestos Products Corporation, 979 Nicoll Street
New Haven 4, Connecticut

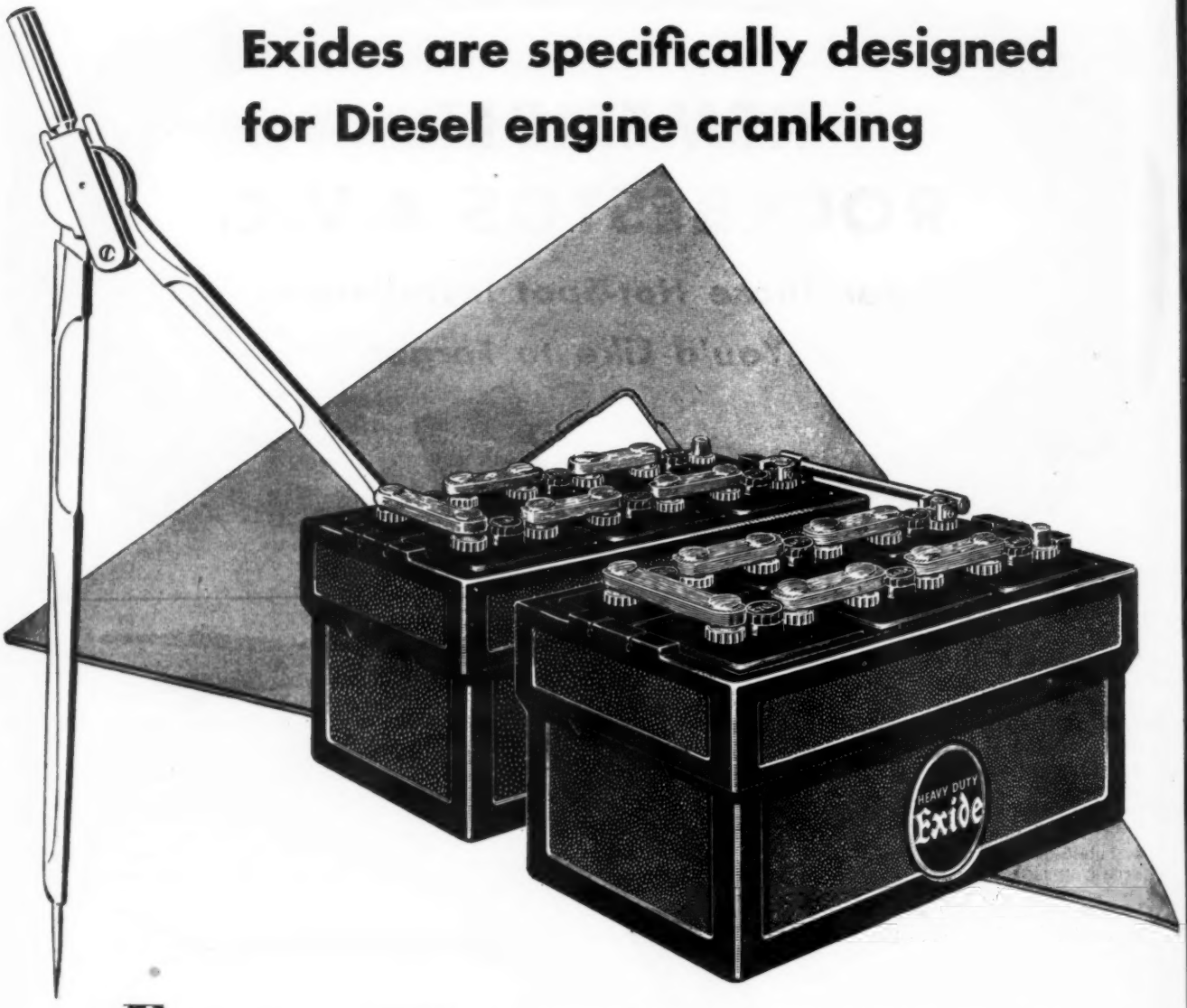
ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, SEATTLE, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, PITTSBURGH, PORTLAND, ORE.

★ **BUY MORE WAR BONDS**

Exides are specifically designed for Diesel engine cranking



From the time when Diesel engines first came into general use, there were Exide Batteries ready to do the cranking. For Diesel development and Exide development have advanced together step by step. With the result, that when the cranking jobs are extra tough, Exides usually are delegated to do them.

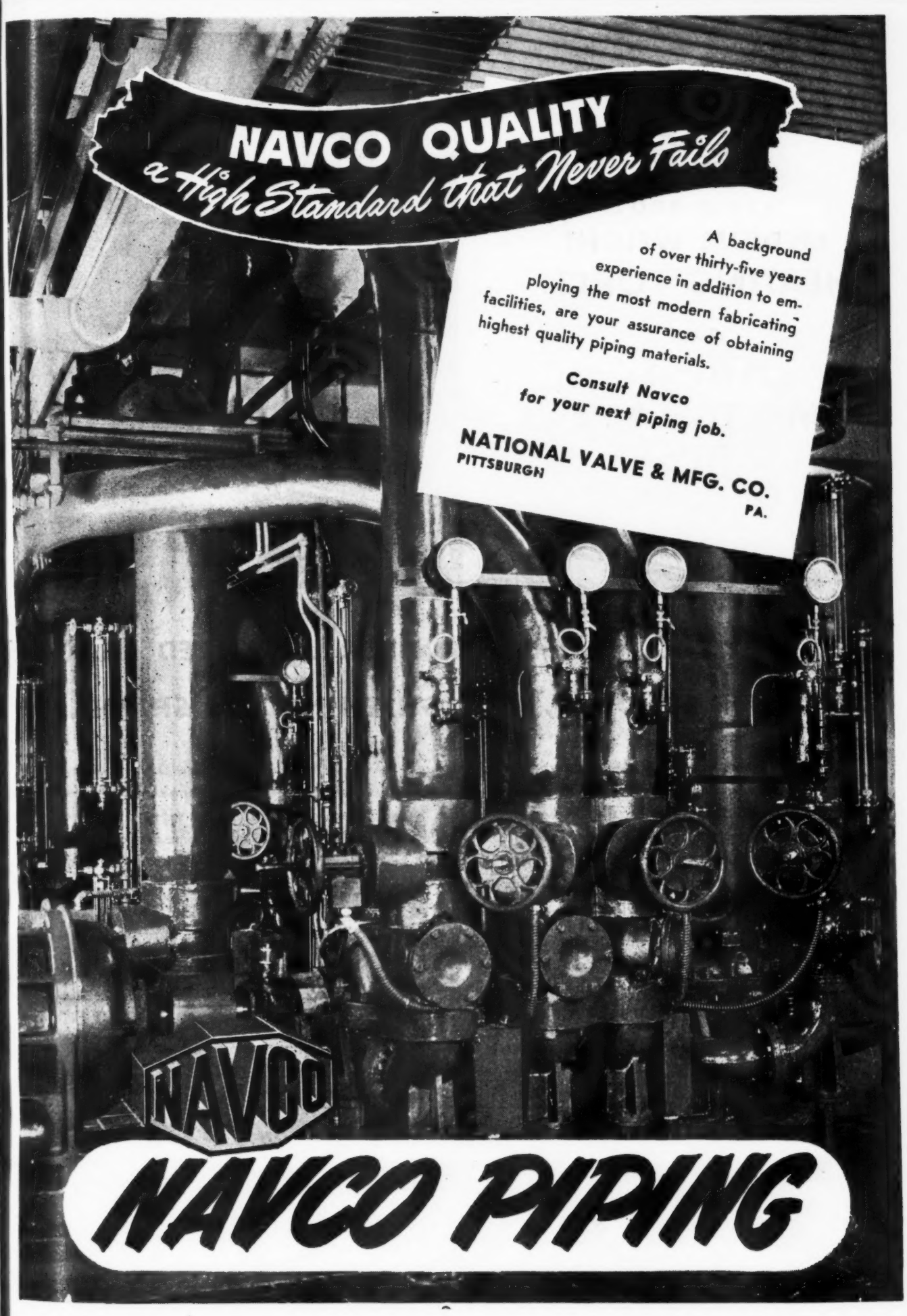
Exides have the extra power required for Diesel engine cranking. They have the rugged build for long, hard service. And regardless of where or how often they are used, you can always count on Exides for dependability, long-life and ease of maintenance.

Write for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Exide Heavy-Duty Batteries.

ARMY E NAVY

Exide
BATTERIES
FOR CRANKING
DIESEL ENGINES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto


NAVCO QUALITY
a High Standard that Never Fails
A background of over thirty-five years experience in addition to employing the most modern fabricating facilities, are your assurance of obtaining highest quality piping materials.
Consult Navco for your next piping job.
NATIONAL VALVE & MFG. CO.
PITTSBURGH PA.
NAVCO
NAVCO PIPING

AIRCO

STYLE 9802
MEDIUM WEIGHT
HEATING TORCH
and
STYLE 724
MULTI-FLAME
TIPS

Ideal Combination FOR LOCALIZED HEATING
for BENDING, STRAIGHTENING and SHRINKING

● Wherever concentrated localized heating is required for bending, straightening and shrinking steel plate and for silver brazing heavy copper plate in the manufacture of pipe, you can select no better equipment for the job than the Airco Style 9802 Medium Weight Heating Torch with the proper size of Airco Style 724 Multi-flame Tip.

The torch is comparatively light in weight, easily handled and gives full freedom to the operator, yet it has large passages through the valves, tubes and head to afford ample gas capacity.

Four extensions have been provided: one 12" straight extension and 18", 24" and 42" angular extensions.

Airco Style 724 Multi-flame Oxyacetylene Tips are available in a complete range of five sizes to meet the requirements of every heavy heating job. Style 717 and Style 718 Multi-flame Propane Tips are also available for use with the Style 9802 Torch.

An Airco representative will be pleased to demonstrate this ideal heating combination on your work. Ask your nearest Airco office.

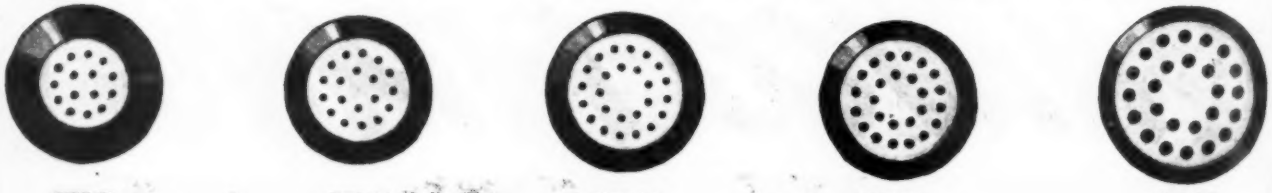
★ BUY UNITED STATES WAR BONDS ★

AIRCO

AIR REDUCTION

General Offices: 60 East 42nd Street, New York 17, N.Y.
In Texas: Magnolia Airco Gas Products Co. • General Offices: Houston 1, Texas
Offices in all Principal Cities

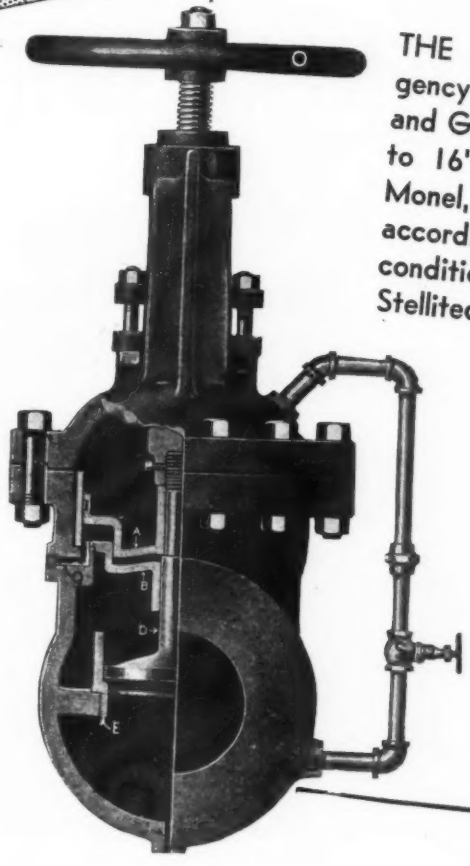
STYLE 724 MULTI-FLAME HEATING TIPS—ILLUSTRATIONS ARE FULL SIZE



SIZE 11 SIZE 12 SIZE 13 SIZE 14 SIZE 15

Here's an "Automatic Brake" for Runaway Turbines

This Throttle and Emergency Stop Valve acts instantly and automatically to prevent any turbine unit from exceeding maximum safe operating speed. It can be invaluable to you because it permits location of trouble before damage occurs.



THE GOLDEN-ANDERSON Emergency Stop Valve is supplied in Angle and Globe patterns, in sizes from 2½" to 16". Valve trim may be Bronze, Monel, Stainless Steel or Gallavoy according to pressure and temperature conditions. Seat rings and disc may be Stellited.

Write today for your copy of the latest G-A Catalog. It illustrates and describes the complete line of G-A Valves.

GOLDEN-ANDERSON
VALVE SPECIALTY CO.
Fulton Bldg., Pittsburgh, Pa.

QUICK POWER FOR EMERGENCIES!

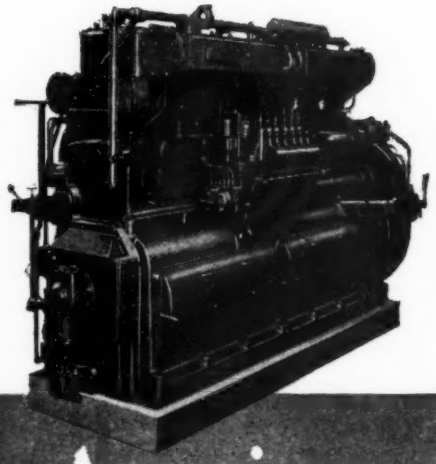
This hospital installed two ALCO Diesel Engines because it wanted quick power ...dependable power...and a compact economy of power plant space!

There are places and purposes where quick, dependable, continuous power is desperately needed. Instant power, from units requiring minimum space. That is one reason why more than 1,500,000 horsepower of ALCO Diesel Engines have been installed!

This extraordinary record was made possible by ALCO'S engineering organization, highly specialized manpower, finely tooled shops...and the enormous advantage of the Diesel engine proving ground provided by ALCO'S vast railroad activities.

Development of better Diesel engines is a continuous process with ALCO. ALCO pioneered the light-weight, high-speed, heavy-duty Diesel engine of greater dependability.

Every Diesel engine ALCO can produce today is needed for war service. But research goes on...and when war ends, you will hear of further ALCO improvements...refinements of engine design that mean better Diesel engine values than have ever before been available for your power plant needs.



American Locomotive

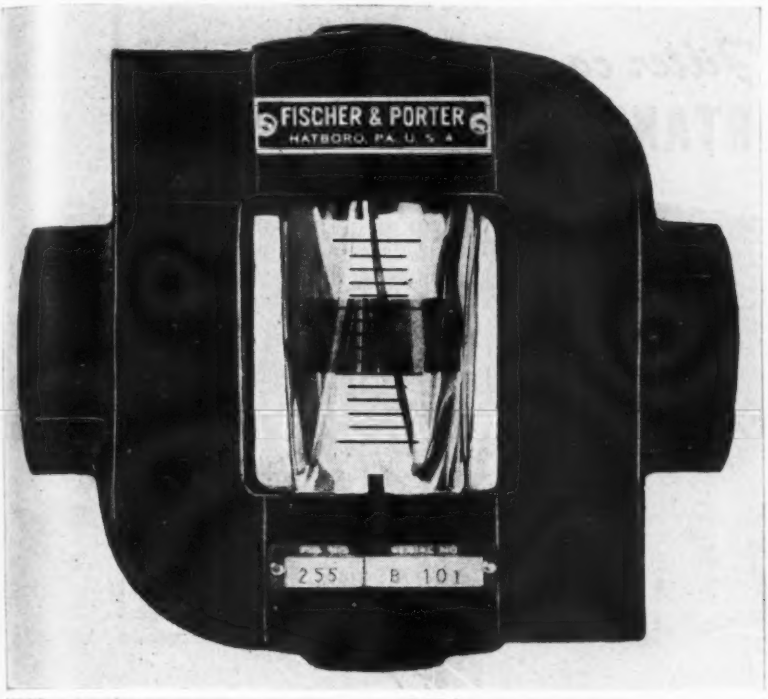
ALCO DIESEL ENGINES

For Universal Application

30 Church St., New York 6, N. Y.

The ROTASIGHT Flow Indicator

—an inexpensive instrument that shows the true flow rate!



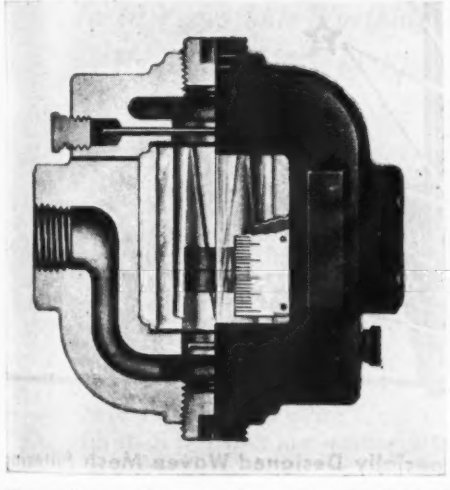


Illustration 1—Cut-away view of the Rotasight. Notice the flow passage through the metal fitting, the precision-bore fluted metering tube, the detachable metering scale, and the way the float stops are installed.

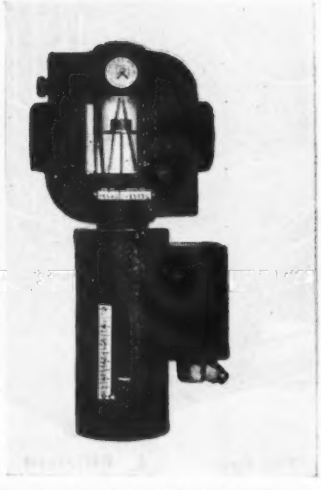


Illustration 2—The Rotasight Alarm with standard extension showing the adjustable alarm switch and pointer for reading the alarm position.

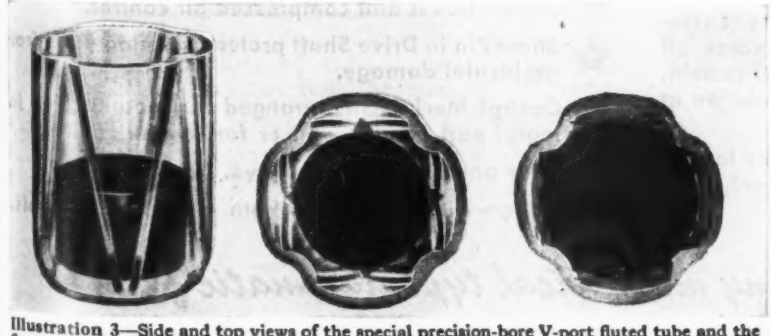


Illustration 3—Side and top views of the special precision-bore V-port fluted tube and the float used in the Rotasight. Top views show the way the space for flow passage (shown in red) increases from low to high flow. Middle photograph shows the float in the lowest position and the right hand photograph shows the float in its highest position in the tube.

IF YOU have certain flows that are not too critical but where a comparative idea of the flow rate would be reassuring and therefore worth a small investment, then the Rotasight is just what you have been seeking. It is a short-scale rotameter with a float which responds immediately to flow changes and which *continuously* indicates the true flow rate.

The Rotasight is compact, and very easy to install since it may be piped horizontally or vertically as desired. Best of all, it is very moderate in price—hardly more than the flapper and wheel-type sight glasses which it replaces because of its more accurate indication of the actual flow rate.

One of the greatest uses of the Rotasight has been as a flow rate alarm. An armature attached to the Rotasight float can be made to trip an external magnetic switch at any point in the flow range of the Rotasight (see Illustration 2) and thus actuate electric relays to sound an alarm, or to start or stop electrical equipment. It is the most practical, inexpensive flow rate alarm available because it responds to flow rate changes *only* and because its flow calibration is a straight line, thus making it equally sensitive at all points of its flow range, whether high or low.

The Rotasight is available in bronze or iron, in sizes from ¼ inch to 2½ inches, with flow ranges starting at 0.03 G.P.M. of water or 0.06 C.F.M. of air in the smallest size and reaching a maximum of 60 G.P.M. of water or 135 C.F.M. of air in the largest size. An idea of the physical dimensions of this instrument may be obtained from the 1 inch size which is approximately 6 inches by 6 inches by 3 inches wide. Standard Rotasights can be delivered in any size within four weeks.

The Rotasight is being used with great success by many leading manufacturers of chemicals and process equipment in such services as water flows to pump sealing glands; lubricants to bearings on turbines, compressors and pumps; cooling water to ignitron tubes, furnace blocks and other water-cooled equipment; distribution of flow to spray nozzles; distribution of gas flows to furnace batteries; overflow warnings; backwashing of small filters, and in many other applications where the certain ability to duplicate the flow rate every day is important or where flow stoppage or flow excess will cause damage or wastage.

The full and interesting details of construction, capacities, dimensions, prices and applications of the Rotasight are given in our new and profusely illustrated Catalog 92-C—just write us for your free copy.

FISCHER & PORTER CO.

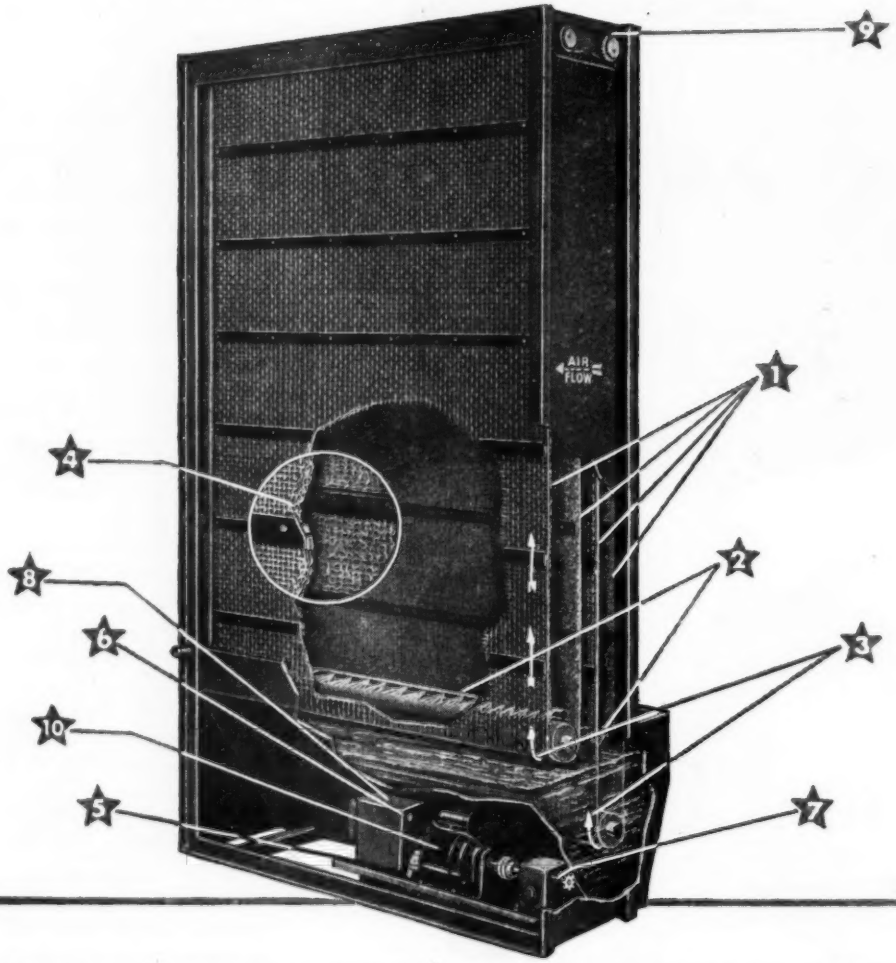
6002 County Line Rd., Hatboro, Pa.

Fischer & Porter Company has pioneered EVERY basic rotameter improvement!

STAYNEW AUTOMATIC

No other Air Filter can give you these

10 IMPORTANT FEATURES



1. *Four* Stages of Filtration (Exclusive feature). The first only of *two* endless filter curtains enters the oil bath. The second, "conditioned" by the special Staynew Air Jet Cleaners, runs semi-dry and prevents oil entrainment *absolutely*.
2. Air Jet Cleaners "Condition" Both Curtains (Exclusive feature). These cleaners remove excess oil with entrapped lint, dust, etc., from the first curtain, and in the second curtain keep oil accumulation at a point where entrainment cannot occur.
3. Direction of Curtain Travel is such that air leaves *clean* side always. The Staynew is the only mechanical type air filter with this feature.
4. Efficient, Specially Designed Woven Mesh Filtering Medium, Wire Cloth Protected (Exclusive feature).
5. Motor & Drive Mechanism cushion-mounted, silent.
6. Momentary Contact Switch for testing and checking curtain travel and compressed air control.
7. Shear Pin in Drive Shaft protects moving parts from accidental damage.
8. Control Mechanism arranged for mounting as integral part of filter unit or for remote control.
9. Gear and Roller Chain Drive. *No belts to slip.*
10. Nation-wide Service on both motor and controls.

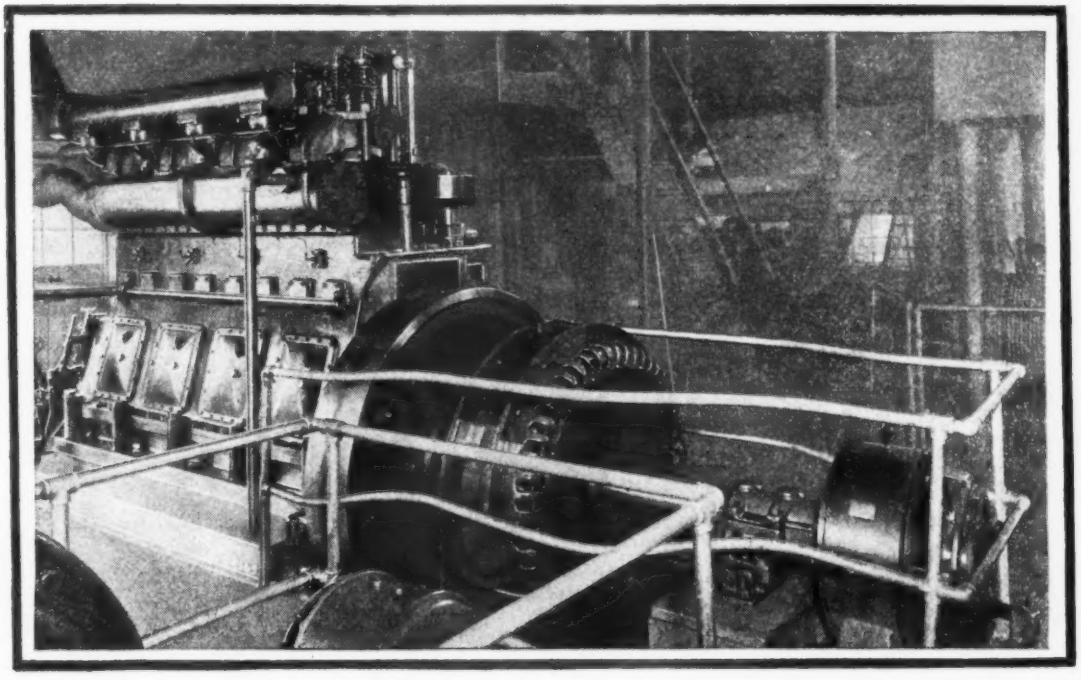
Highest efficiency of any mechanical type automatic filter

DOLLINGER CORPORATION

(FORMERLY STAYNEW FILTER CORP.)

23 CENTRE PARK ROCHESTER 4, N. Y.

LET'S LOOK AT THE RECORD...



In 10 Years This Worthington Diesel Delivered 8,511,660 KW. HRS. —Running 96.5% of Elapsed Time On Toughest Oil Field Service

Performance of Worthington Diesels under some of the severest service conditions in Industry . . . is a good indication of how they will perform in your plant.

For instance, this 4-cycle, heavy-duty engine furnished power for motor-driven water pumps repressuring oil wells, and for two or three 25/65 hp. motors usually used on drilling rigs . . . during 10 record years in Bradford, Pennsylvania. Resold, it is still giving satisfactory service today.

For full details, write for Bulletin RP-203, a reprint of an article in a leading Diesel publication.

HANDY GUIDE TO DIESEL COSTS AND APPLICATIONS

Send also for "Diesel Engines", an informative discussion by a Worthington engineer. It describes how to estimate costs of different types of power . . . gives facts on Diesel power progress and applications, on pipe lines, in water works, for refrigeration, air conditioning and general industrial service. Ask for Bulletin WG1-74.

Worthington Pump and Machinery Corporation, Harrison, N. J.

Ten-Year "Box Score" of a Worthington Engine

Total KW. hrs. generated.	8,511,660
Running-engine-capacity factor . . .	55.0%
KW. hrs. per gal. fuel	11.7
Rated engine hp.per gal. lubricating oil	2064
Total 10-year cost of engine repairs .	$708.00
Average liner wear per 10,000 hrs.	15/10,000 inches

Total 10-year cost of generating power, including labor, fuel oil, lubricating oil, repairs and supplies, interest, amortization, overhead, taxes and insurance . . . *9.68 mills per KW. hr.*

WORTH BEHIND THE NAME
WORTHINGTON

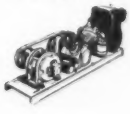
DE4-2

YOUR PARTNER IN POWER PROGRESS

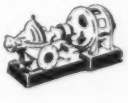
WORTHINGTON-BUILT AUXILIARIES

Evaporative Type Engine Water Cooler

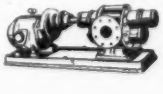
Starting Air Compressors



Cooling Water Circulating Pumps



Oil Transfer Pumps



Diesel engines, 150 to 2,600 hp . . . gas engines, 175 to 2,880 hp . . . convertible fuel engines, 150 to 1,720 hp.

Here's why ALDRICH-GROFF "POWR-SAVR" PUMPS *actually* SAVE POWER

In medium and high pressure services—

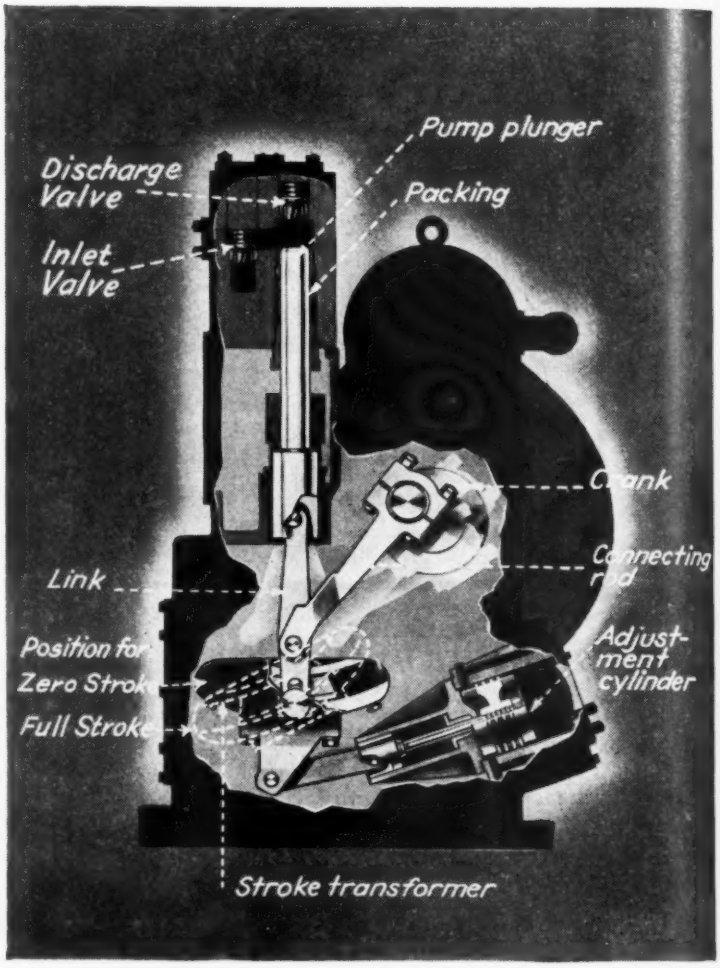
- ***Boiler Feeding***
- ***Desuperheater Feeding***
- ***Process Charging***
- ***Pipe Line Pumping***
- ***Hydraulic Pressure***

Because these unique constant-speed variable-delivery pumps are designed to afford flexibility of capacity so that power consumption is practically proportional to delivery demands, substantial savings are assured. And, a self-contained dustproof lubrication system automatically provides oil supply under constant pressure to all bearing points —assuring continued high efficiency and low maintenance expense.

Where it pays to invest money for the efficient combustion of fuel and generation of power, or for economical process equipment, it is equally important and financially attractive to utilize power with a comparable degree of efficiency. It is the function of the ALDRICH-GROFF Pump to most efficiently utilize pumping power, particularly where variable rates of pumping are involved.

These pumps may be automatically or manually controlled from any remote point of control to provide stepless straight line variation ranging from zero to full delivery. They are adapted for operation with any standard automatic controller of the "air pilot" type responsive to variations in liquid level, flow, temperature, pressure or other desired conditions.

Now available in six standard sizes ranging up to 100 B.H.P. and for pressures up to 15,000 PSI, ALDRICH-GROFF Pumps are being increasingly



Length of plunger stroke is governed by position of stroke transformer. At zero delivery, link has pendular motion and plunger does not move. As stroke transformer is rotated toward full delivery position (shown by dotted lines) vertical component of linkage increases until full stroke is obtained. Thus, no change in pump speed is required to vary pumping capacity.

used wherever power savings, extreme mechanical reliability and simple accurate control of delivery is important. Since being announced in 1939, more than 300 of these pumps have been placed in varied services and have established enviable performance records under severe and exacting service conditions.

For a more detailed description of ALDRICH-GROFF principles write for Bulletin 65.

ALDRICH

THE ALDRICH PUMP CO. **ALLENTOWN, PENNA.**

REPRESENTATIVES: Birmingham • Bolivar, N.Y. • Boston • Chicago • Cincinnati • Cleveland • Denver • Detroit • Duluth • Houston • Los Angeles • Pittsburgh • Portland, Ore. • St. Louis • San Francisco • Seattle • Tulsa

FOOTSTEPS

leading to Scientific Feedwater Service

Six steps follow the pathway to properly conditioned boiler water in the Dearborn water treatment plan:

Step 1 . . . The Dearborn Engineer studies your water and plant operation conditions.

Step 2 . . . He sends samples of your water to the main laboratory for analysis.

Step 3 . . . Recommends proper chemical treatment and chemical control methods.

Step 4 . . . Supervises installation of feeding equipment in your plant.

Step 5 . . . Instructs your men on water test methods for treatment, dosage adjustment, and blowdown control.

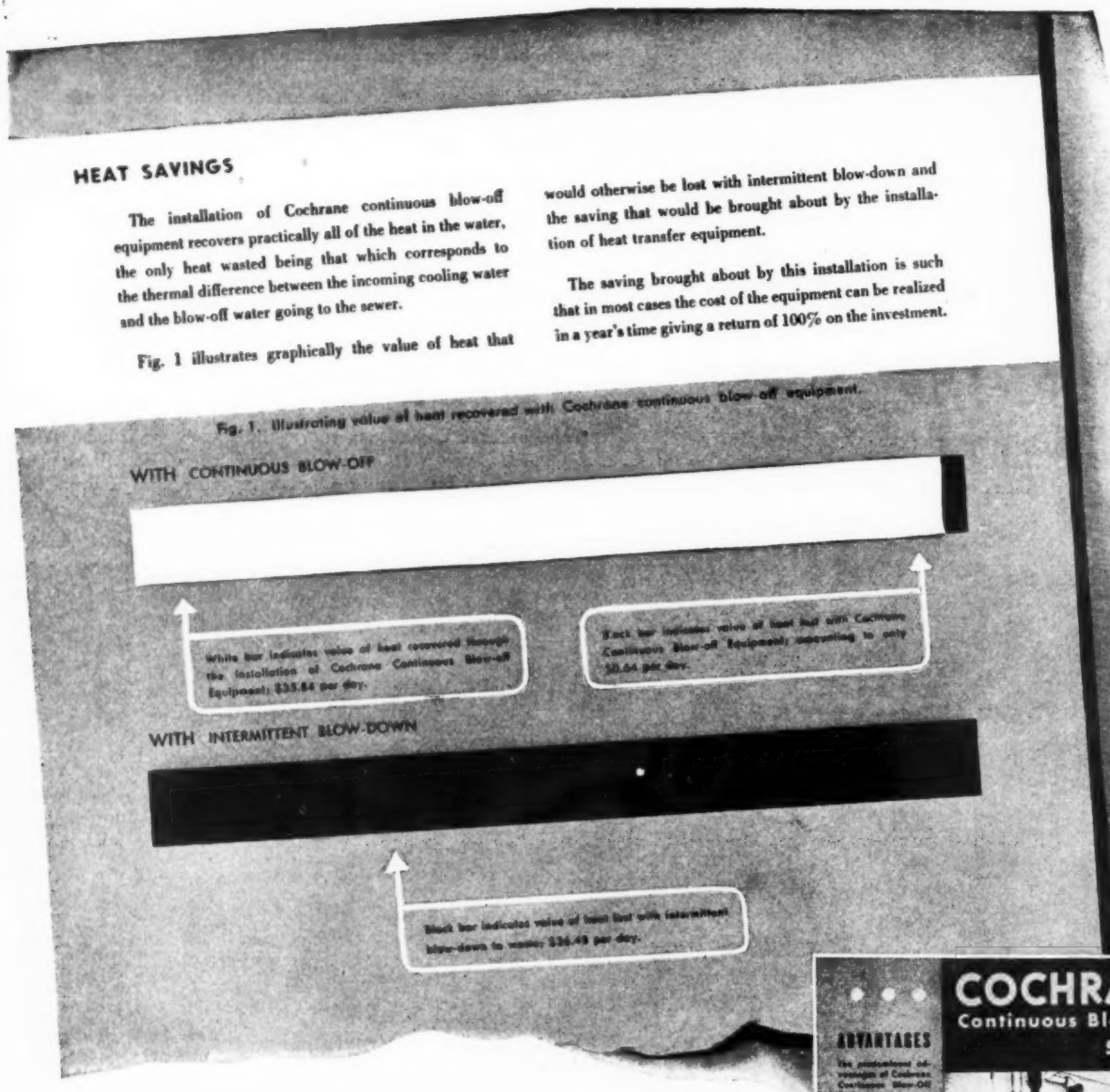
Step 6 . . . Calls regularly to insure maintenance of recommended conditions.

*The Dearborn Engineer in your vicinity knows your local water characteristics because he lives and works there. He will be glad to serve you in formulating a balanced treatment program for your plant.

Dearborn
TRADE MARK REGISTERED

BOILER WATER TREATMENT AND SERVICE

DEARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Ave.
Chicago 4, Illinois



HEAT SAVINGS

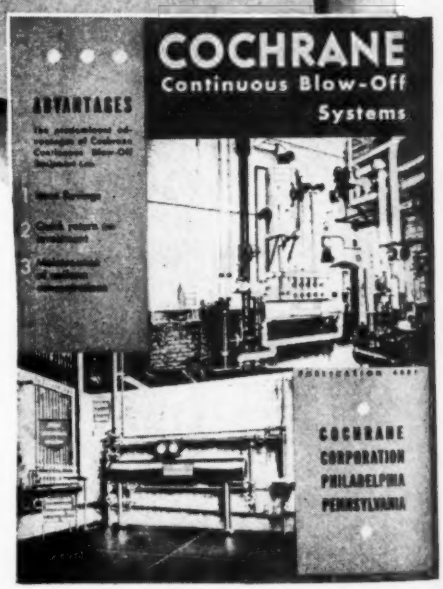
The installation of Cochrane continuous blow-off equipment recovers practically all of the heat in the water, the only heat wasted being that which corresponds to the thermal difference between the incoming cooling water and the blow-off water going to the sewer.

Fig. 1 illustrates graphically the value of heat that would otherwise be lost with intermittent blow-down and the saving that would be brought about by the installation of heat transfer equipment.

The saving brought about by this installation is such that in most cases the cost of the equipment can be realized in a year's time giving a return of 100% on the investment.

Fig. 1. Illustrating value of heat recovered with Cochrane continuous blow-off equipment.

WITH CONTINUOUS BLOW-OFF
White bar indicates value of heat recovered through the installation of Cochrane Continuous Blow-off Equipment: $33.84 per day.
Black bar indicates value of heat lost with Cochrane Continuous Blow-off Equipment; amounting to only $0.64 per day.
WITH INTERMITTENT BLOW-DOWN
Black bar indicates value of heat lost with intermittent blow-down to waste: $34.49 per day.



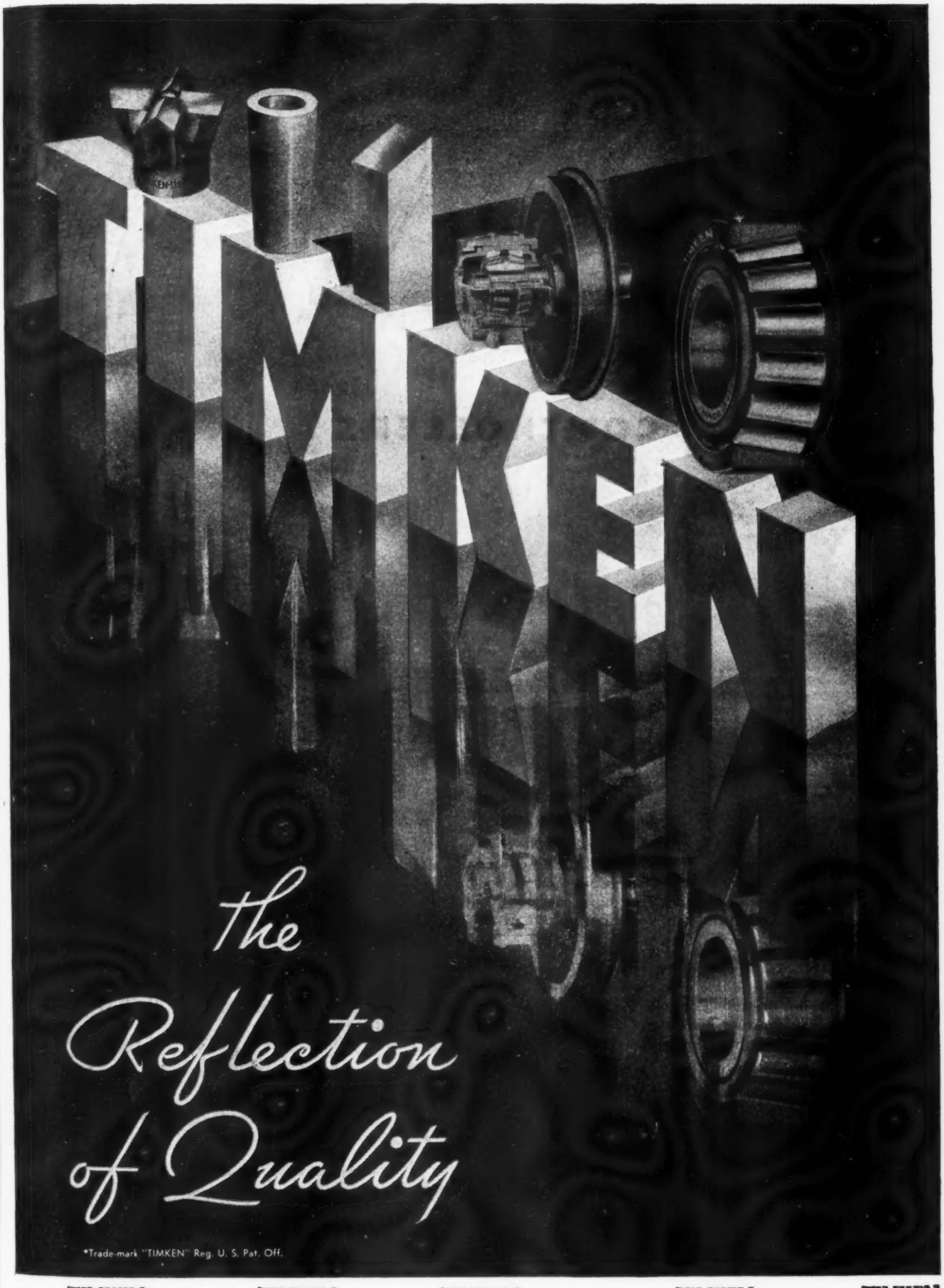
ABOVE is a page from the new Cochrane Publication No. 4081 on Continuous Blow-Off Systems. The example of savings shown on this page is not at all exaggerated but is based on a representative problem in boiler blow-down. In installation after installation the cost of the Cochrane Continuous Blow-Off System is recovered so quickly that *net* savings often begin inside of a year.

This comprehensive bulletin on the subject of Continuous Blow-Off is just off the press. It will pay you to go over it and see if your present system of boiler blow-down is not wasting money. Write for Publication 4081.

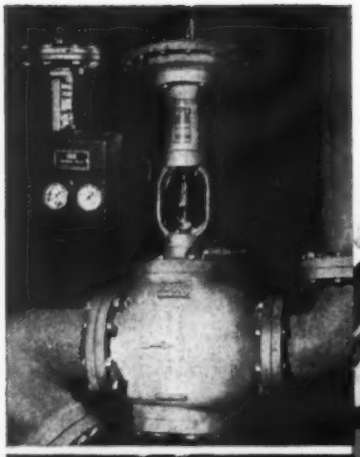
COCHRANE CORPORATION — 3106 N. 17th Street — PHILADELPHIA 32, PA.

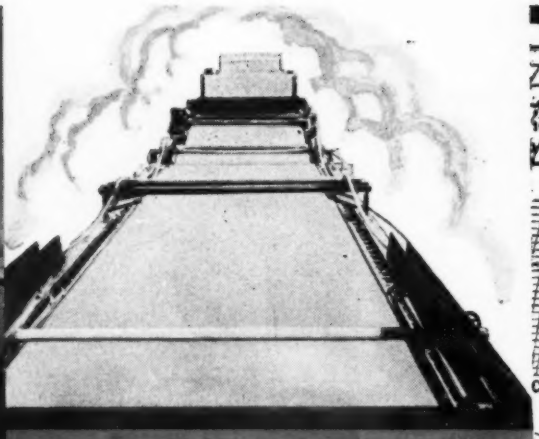
COCHRANE

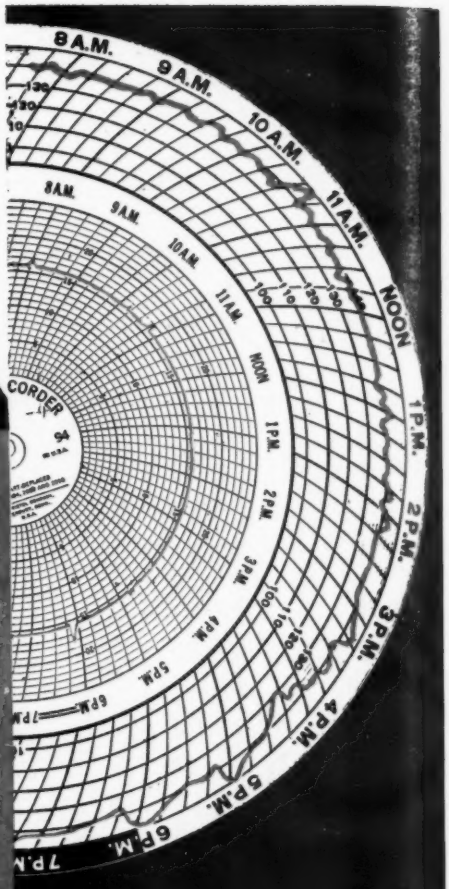
SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES



TIMKEN Tapered Roller Bearings | **TIMKEN** Alloy Steels | **TIMKEN** Seamless Steel Tubing | **TIMKEN** Railway Roller Bearings | **TIMKEN** Rock Bits







Connected in series, these Leslie Pressure Controllers regulate process steam with laboratory precision—necessary to maintain constant steam pressure to Fourdrinier machine (above center) and regulate paper finish and thickness.

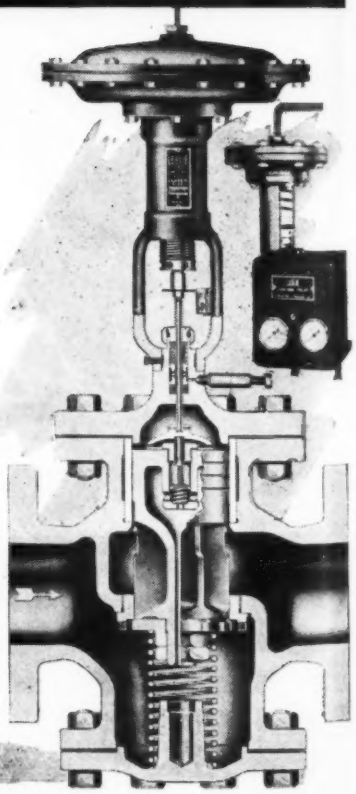
LESLIE CONTROLLERS ARE IN AT THE FINISH ON HAMERSLEY PAPERS

NOTE "LIVE" LINE ONLY ¼ LB. WIDE on low pressure chart and compare it with the wide fluctuations shown on the inlet steam chart. That's CONTROL!

CLOSE REGULATION OF STEAM PRESSURE to the drying rolls is essential in maintaining the micro-fine finish of Glassine and Greaseproof papers at Hamersley Manufacturing Company. For the past five years, this task has been made easier by the use of Leslie Pressure Controllers. They have constantly held the steam pressure at the required 16 p.s.i. within ¼ lb. variations in spite of 20 lb. fluctuations in the nominal 140 p.s.i. inlet.

IN YOUR PLANT, TOO, extreme pressure reductions and overflow control with close throttling on dead end and even action over the entire range may be required. That is where Leslie Pressure Controllers excel. Or you may need the fast valve action of the Leslie Pressure Reducing Valves, Pump Governors and Temperature Controllers with their internal pilot, piston-actuated valves.

CLOSE REGULATION, AND LOW MAINTENANCE are Leslie characteristics because Leslie Controllers incorporate such refinements as non-continuous leakage of auxiliary medium, friction-free stem design of Control Pilot for quick responsive action with small pressure changes, stainless steel seats and discs, and single seated, fully balanced inner valve construction for diaphragm regulating valves. To learn how Leslie Controllers can maintain quality in your plant, write for Bulletin 402.



ESTABLISHED 1900

LESLIE

REGULATING VALVES
LESLIE-TYFON WHISTLES

LESLIE CO., LYNDHURST, N. J.

THE Right Cable
FOR THE JOB
NOT BY ACCIDENT . . . BUT BY DESIGN
Intelin
Federal Telephone and Radio Corporation
TABLE I—SINGLE BRAID TYPES
TABLE II—DOUBLE BRAID TYPES
TABLE III—ARMORED TYPES
TABLE IV—AIR SPACED LOW CAPACITANCE TYPES
TABLE V—DUAL CONDUCTOR (TWINAX) TYPES
ANTENNAE LEAD IN WIRE
TABLE VI—DUAL COAXIAL TYPES

To assist the equipment designer Federal offers comprehensive data on high frequency cables.

This technical information sheet provides the design-engineer with pertinent electrical and physical characteristics...including impedance, capacitance, attenuation, diameter, materials, and weight ... for Federal's wide variety of high-frequency cables.

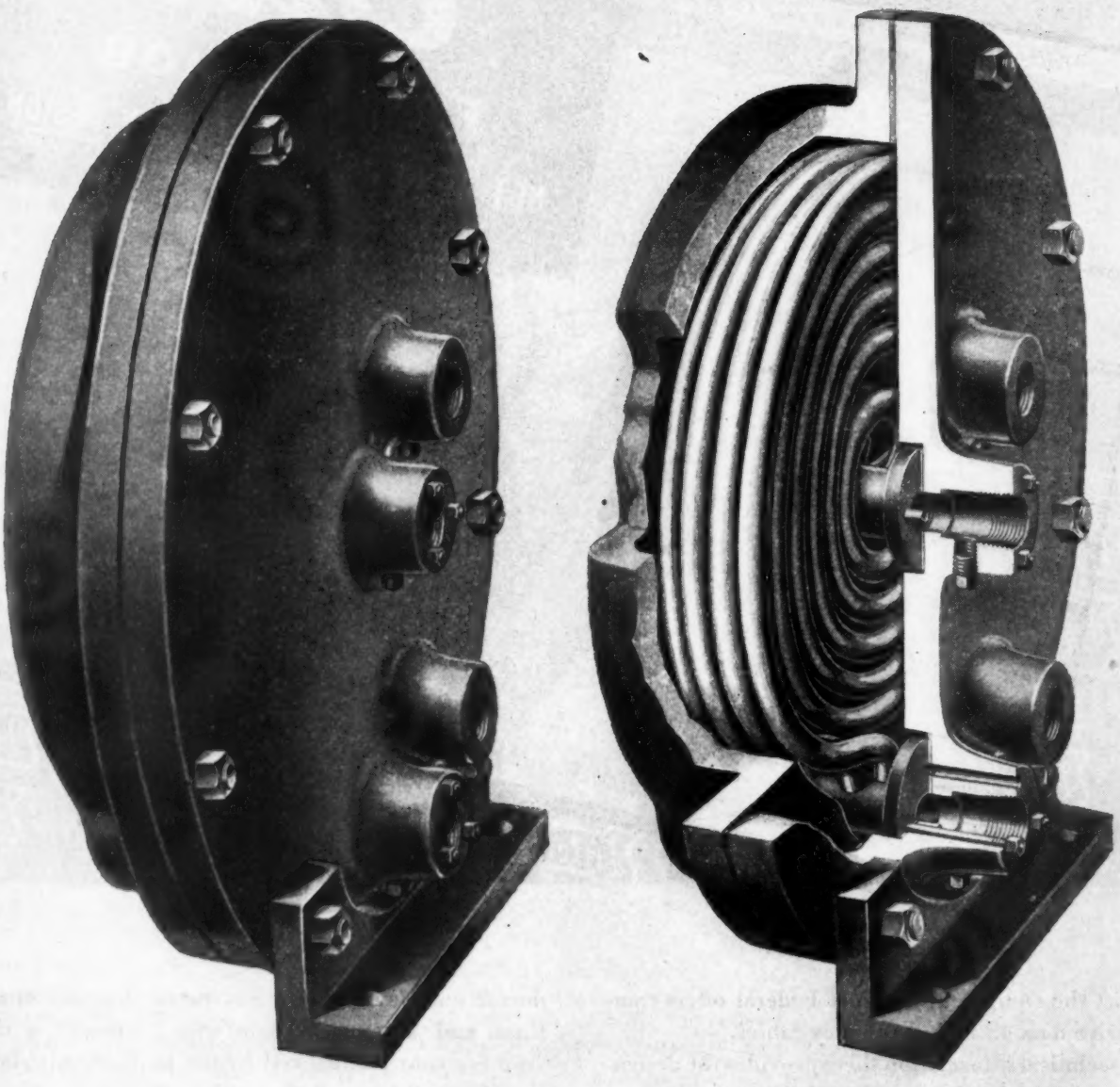
Single and double braid, armored, dual conductor and dual coaxial, air-spaced, low capacitance lines, and antenna lead-in wire . . . there's a right type for your job, backed by the built-in superiority that's a tradition with Federal.

Special developments in flexible low-loss cables by Federal have resulted in superior cables for all types of transmission. For a better job, see Federal first.

Write for your cable information sheet today.

Federal Telephone and Radio Corporation

"HELIFLOW"
COOLERS AND HEATERS



The Compact, Efficient Versatile HELIFLOW
The Heat Exchanger of a Thousand Uses. Send for Bulletin 58

AWARDED THE MARITIME "M" PENNANT AND VICTORY FLEET FLAG APRIL 8, 1944

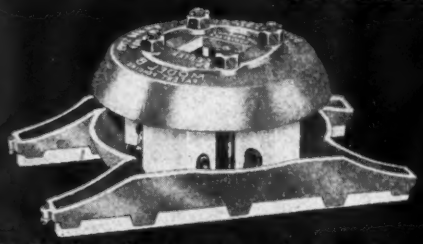
GRAHAM MANUFACTURING CO., INC.

415 LEXINGTON AVENUE • NEW YORK 17, N. Y.

Non Chemical

BOILER WATER TREATMENT

Is Keeping Thousands of Boilers Free of Scale and Corrosion



De-Scalers have no moving parts, and require no adjusting

FROM A PROMINENT USER

June 28, 1944

Butler Engineering Co.,
926 Magazine Street,
New Orleans 11, La.

Gentlemen:

We have seven water tube boilers ranging in sizes of-150, 250, 460, and 1060 rated horsepower operating during peak loads that are over 200% of rating and all the boilers are equipped with Butler De-Scalers. These De-Scalers were first installed in May of 1943. Tests were run and periodical inspections made with the result that we are now using the De-Scalers exclusively.

The city water in this locality is hard and contains a high percentage of solids. We use the Permutit Zeolite Water Softener to rectify this condition somewhat.

We have not used the tube turbine since the installation, in fact what scale was on, had peeled off.

Continuous blow down is made use of on all boilers, these were installed as directed by Butler Engineering.

We feel that the De-Scalers are doing a job for us. You ask what difficulties we had prior to our installation of De-Scalers. This question may best be answered in dollars and cents.

Using chemical treatment, we had to change the dosage to comply with laboratory recommendations; we had to depend upon the human element; to execute the order, the boiler blow down was directed by the chemical laboratory. Sometimes it would take 3 weeks to turbine the tubes and scrape the drums. We kept close of these costs; as per day per boiler. With De-Scalers it cost $.87 per day per boiler minus the human element and the unnecessary waste of heat through the blow downs. $3.50

We took a battery of 3 De-Scalers out of our #2-460 HP boiler this past week after 6 months of hard service. The cartridge showed very little errosion and are good for more than 12 months of additional service.

HENRY HEIDE

INCORPORATED

Established 1869

Quality Candies
Bakery Products

SPRING, HUDSON & VAN DAM STREETS
NEW YORK, N.Y.
CABLE ADDRESS "LIACINE" NEW YORK

May 24, 1944

Mr. Frank Spillane
c/o William McDonagh & Sons
180 Front Street
New York, New York

Dear Sir:

We have installed Butler De-Scalers in 8 of our 400 H.P. Babcock and Wilcox water tube boilers; and I am pleased to inform you, that we are very much satisfied with the results obtained from the Butler De-Scalers.

Yours very truly,
HENRY HEIDE, INCORPORATED
John Hofmann
John Hofmann
Chief Engineer

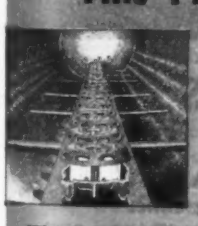
JH:biv

BUTLER DE-SCALERS*

De-Scalers provide a more satisfactory water correction, as their performance is predicated on a simple basic principle. The wide-spread preference for this non-chemical and reliable water treatment results in part from the De-Scaler's years of performance in thousands of boilers throughout the world. De-Scalers furnish the most modern and economical water correction obtainable. Not alone does the De-Scaler keep all inside surfaces of the boiler clean, but protects the entire piping system against corrosion.

De-Scalers have been developed to operate in boilers up to 350 psi.

This Protection Saves Boilers

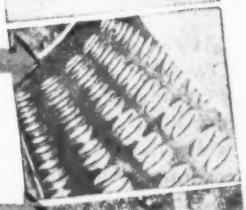


SCALE

The submerged De-Scaler by its self-induced action precipitates the scale-forming salts contained in the boiler water, preventing the formation of new scale. This action gradually removes all old scale, regardless of its thickness or type.

PITTING

The low current generated by the De-Scaler is greater than the current generated in the boiler, and overcomes lesser electrolytic effects of other metals in the boiler. Such pitting action takes place on the Butlermetal Cartridges, which disintegrates.



CORROSION

The Butlermetal cartridges have a far greater affinity for dissolved oxygen than any metal in the boiler, and thus bear the brunt of the corrosive attack.

*Patented; other patents pending. Trade-mark Reg. U. S. Patent Office.

DE-SCALER PERFORMANCE IN THE BOILERS

- No water analysis necessary.
- Stops scale formation.
- Causes the removal of old scale.
- Stops foaming and priming.
- Prevents electrolytic and oxygen corrosion.
- Will not harden soft packing.
- Will not corrode metalic packing.
- Eliminates hand scaling, tube turbining.
- Will maintain a proper PH value.
- No long boiler shut down for cleaning.
- No chemicals or Boiler Compound.

SEND FOR BOOKLET
"Presenting Butler De-Scaler"

BUTLER ENGINEERING CO., 926 MAGAZINE STREET, NEW ORLEANS 11, LA., U.S.A.
Distributors with Stocks and Service in Important Industrial Centers throughout the United States.
Export Representatives: WM. McDONAGH & SONS, 180 FRONT STREET, NEW YORK 7, N. Y. U. S. A.
Canadian Representatives: JOHNS MACHINE AND TOOL COMPANY, 484 McGILL STREET, MONTREAL 1, CANADA

Built to Outlast the Boiler...

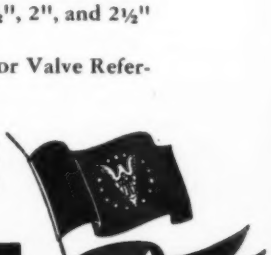
. . . with Hovalco-Homestead Blow-Off Valves

Reports of HOVALCO-HOMESTEAD COMBINATION BOILER BLOW-OFF VALVES with records of 25 to 30 years continuous service are not uncommon. Their long life, and *up to 60% lower maintenance cost,* are due to advanced valve design and method of operation which limit practically all service wear to the special, high-silicon, monel seat and disc of the Hovalco Angle Valve. And this seat and disc, being *reversible,* need only be *turned over,* when wear occurs, to provide *new* seating surfaces and a good-as-new valve for another long, trouble-free period of service.

HOVALCO-HOMESTEAD COMBINATION BOILER BLOW-OFF VALVES, including either Lever-Seald or Cam-Seald, Quarter-Turn Plug Valves, meet all state laws and the A.S.M.E. Boiler Code. They can be furnished in 1½", 2", and 2½" sizes, for pressures up to 600 lbs.

For detailed information write for Valve Reference Book No. 38.

"M" Pennant with three additional gold stars —Maritime's highest production award to our men and women making Valves for the Victory Fleet.



HOMESTEAD VALVE MFG. CO.

P. O. BOX NO. 210 · CORAOPOLIS, PENNSYLVANIA

Where the need is

More Speed

..transmit power through a Philadelphia

TYPE HI HIGH SPEED UNIT

For applications where shaft speeds and pitch line velocities exceed the limits for standard commercial parallel shaft gear units, the Philadelphia Type HI High Speed Unit has performed with great satisfaction. These drives are equipped with special force feed lubrication of gears and a water cooled heat exchanger to dissipate the heat generated in high speed operation. Special bearings keep the gears running true. Noise and vibration are kept to a minimum through the balancing of the gears combined with rigid bearing mounting. The gears, hobbed on special machines are double helical to balance the thrust reaction.

The Type HI units are ideal for turbine drive to pumps or other machinery or for speed increasers from low speed motors or engines to high speed pumps or fans.

Illustrated above is a typical drive which transmits 1800 H. P. continuously from a 685 R. P. M. water wheel to a 1200 R. P. M. generator.

We will gladly give you further information about Philadelphia High Speed Units . . . tell us your problem.

ARMY E NAVY

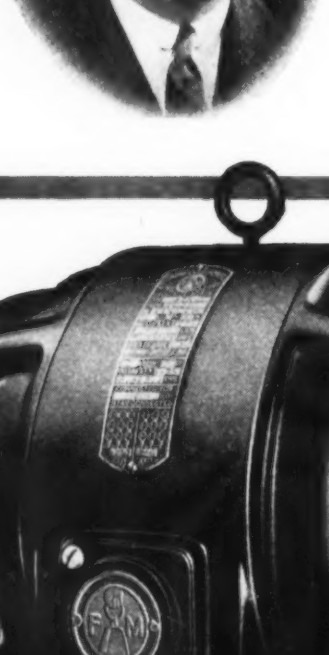
Philadelphia GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

"A name worth remembering"

FAIRBANKS-MORSE



Fairbanks-Morse postwar products will serve you with the *dependability* the world has come to associate with our name. Designing and manufacturing skills will not have to be re-learned in our plants as we turn to civilian production, because as a part of our war job, we've continued to build and improve our peacetime Diesel engines, generators, motors, pumps, and scales.

R. A. Morse Jr.

General Sales Manager

The New Fairbanks-Morse General-Purpose Motor Offers These Features:

- **Copperspun Rotor** — centrifugally cast, exclusive.
- **Protected Frame** — excludes solids and liquids.
- **Optional Conduit Box Assembly** — conveniently adaptable.
- **Cross-Flow Ventilation** — assures uniform cooling.
- **Ball Bearings** — sealed in, protected.
- **Rated 40° C.** — continuous duty.

MOTORS

Diesel Locomotives • Diesel Engines
Scales • Generators • Motors • Pumps
Magnetos • Stokers • Railroad Motor
Cars and Standpipes • Farm Equipment

FAIRBANKS, MORSE & CO.
CHICAGO 5, ILLINOIS

Buy More War Bonds

AN Airtight ENCLOSURE

A bubble is nature's perfect air-tight enclosure having a skin through which no air can pass. Of course we wouldn't try to enclose heat in a bubble but Detrick engineers have employed the principle of an air-tight skin in their furnace enclosures.

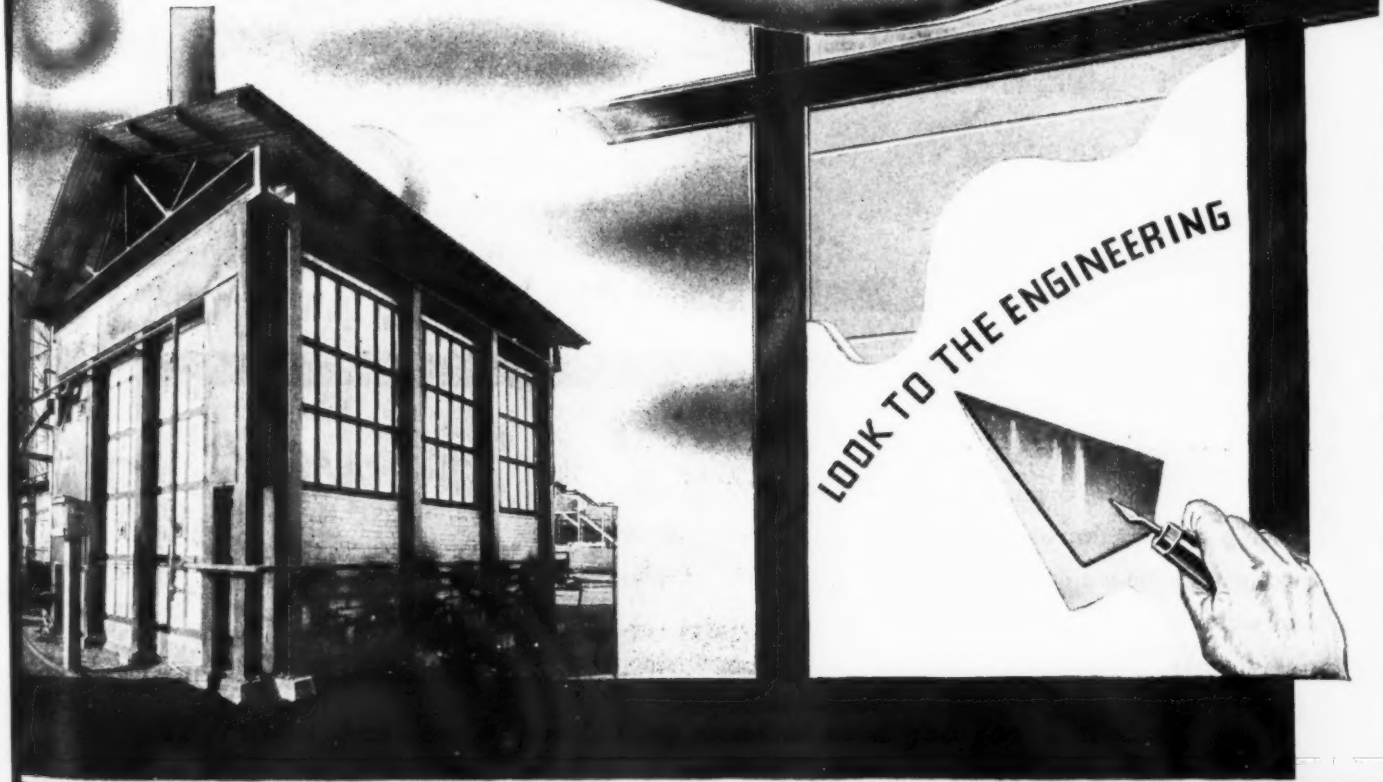
This skin is in the form of a plastic outer casing applied with a trowel to the back of the insulation and keyed in position in small panels by the refractory supporting members. Such a casing completes the furnace enclosure and provides a neat, weatherproof covering. Since it is applied directly to the back of the insulation which itself is laid against the back of the refractory, there is no opportunity for blind leaks to develop.

This is another example of the type of Detrick engineering which has enabled this organization to render outstanding service to thousands of America's leading industrial concerns.

If your present or post-war plans include new furnaces or modernization of equipment, our engineers would like to have the opportunity of making suggestions. Send your blueprints in and ask for a copy of the new book DETRICK FURNACE ENCLOSURES which brings you up to date on this important subject.

M. H. DETRICK COMPANY

111 West Washington Street Chicago 2, Ill.



DETRICK FURNACE ENCLOSURES

USE DETRICK INSULATION . . . *PLASTIC or BLOCK*

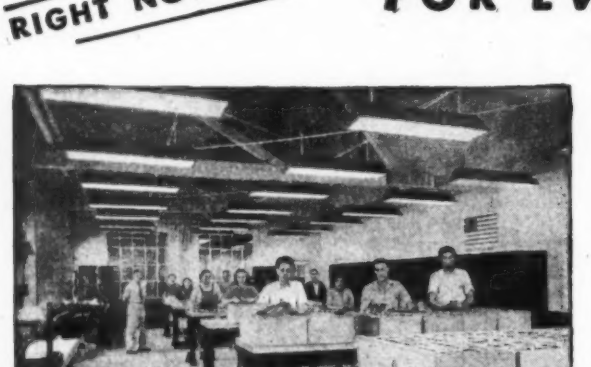
1945

Post-war pipe dreams you better not count on

LIGHTING YOUR PLANT WITH LUMINOUS PAINT = Someday, perhaps, a paint that's charged with atomic energy will flood the plant with light — electric fixtures won't be necessary. But today it's still a pipe-dream.

BUT YOU CAN PLAN RIGHT NOW FOR —

LIGHTING THAT'S RIGHT FOR EVERY SEEING TASK



New industrial lighting units, both fluorescent and incandescent, will furnish an adequate level of glareless illumination for jobs that once seemed impossible to light well. In areas where combustible dusts are present, for example, this type of sealed illumination unit eliminates a hazard, and simplifies maintenance. It's backed by the application aid of Graybar Lighting Specialists.

GRAYBAR'S NATIONWIDE NETWORK

of more than 80 warehouses assures you a convenient local source of supply for more than 60,000 electrical items—backed by experienced application aid on problems of wiring, ventilation, intercommunication and power apparatus. A Graybar Man near you is ready to make your electrical supply problems his personal responsibility. Why not take advantage of his time-saving assistance?

5512

via GraybaR

ATTENTION—MANUFACTURERS OF ELECTRICAL EQUIPMENT AND APPLIANCES:

To help plan for more efficient post-war distribution—national or regional—write for this new booklet: "Tomorrow's Electrical Distribution—via Graybar."

Nothing Complicated About

REEVES SPEED CONTROL

☆

Simple, Rugged, Accurate —Easy to Install, Operate and Maintain

For this engine lathe, in a West Coast Machine Shop, the rugged REEVES Variable Speed Transmission was selected for its absolute accuracy in providing the correct turning speeds at all times for each set-up. Note extended hand wheel control for varying speed.

The operation of a REEVES Variable Speed Drive is as simple as A. B. C. The operating principle and construction are readily understandable at a glance.

There are no delicate electrical or mechanical "gadgets" to require expert adjustment or repair—no fragile parts to break or be affected by wear. Like Old Man River, a REEVES drive "just keeps rolling along," day after day, month after month, year after year with minimum maintenance attention. Records that REEVES Transmissions are still providing accurate, dependable speed adjustability after 40 and more years' constant service are not unusual.

Time-Tested Operating Principle

REEVES is now in its 57th year of continued pioneering in the field of variable speed control. There have been many improvements and refinements in the design and construction of REEVES units, but the operating principle is the same—time-tested and proved in more than 265,000 installations on all types of driven machines in all types of plants.

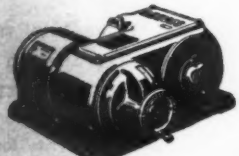
Solves Production Problems

REEVES Speed Control is the answer to accurate production control in a large number of manufacturing operations—feeding, cutting, drilling, stamping, conveying, mixing, heating, winding, etc. It provides instant *accurate* speed adjustability for every changing condition. Tell us what you want to accomplish. Our staff of seasoned Speed Control engineers is at your service to help you solve your problem. Write us.

The 3 Basic Units in the Reeves Line

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over wide range. Send for Catalog T-443.

VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive. Send for Catalog V-440.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Send for Catalog M-441.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

REEVES *Accurate Variable* **SPEED CONTROL**

in Condor V-BELTS

put your horsepower in Victory's harness

—through flexibility, lasting service and extreme lack of stretch. Stout, tough strands of pre-stretched cords in the Whipcord Neutral-Axis Section, carry the load smoothly from motor to machine. These Whipcords—the load-carrying sinews in Condor V-Belts—fortify the FLEXLASTICS* in which they are embedded and through which they dissipate the heat from internal friction and high-speed flexing.

Outwardly these basic qualities are not visible to the eye, but they confirm their value to you in months—often years—of added service, which is translated into more efficient power transmission, greater production, added profit and a better position when full-scale competition returns to enforce production cost control.

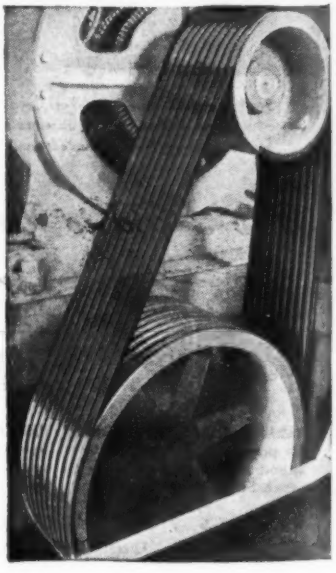
Condor V-Belts are only one of the many MANHATTAN industrial rubber products in which FLEXLASTICS,* with engineered and correctly placed Strength Members, deliver added service. The Condor Whipcord Strength Member is a MANHATTAN development.

Get ready now for the day when restrictions are dropped and write for the new Condor V-Belt Bulletin No. 6868B.**

8 POINTS OF BALANCE

1. Wide margin of strength
2. Minimum inelastic stretch
3. Uniform flexibility
4. Maximum resistance to structural breakdown
5. Smooth running
6. Maximum traction
7. High resistance to side wear
8. Correct lateral reinforcement

These 8 Points correctly embodied in every Condor V-Belt. Other factors being equal, the useful life of a V-Belt is limited by excessive stretch.

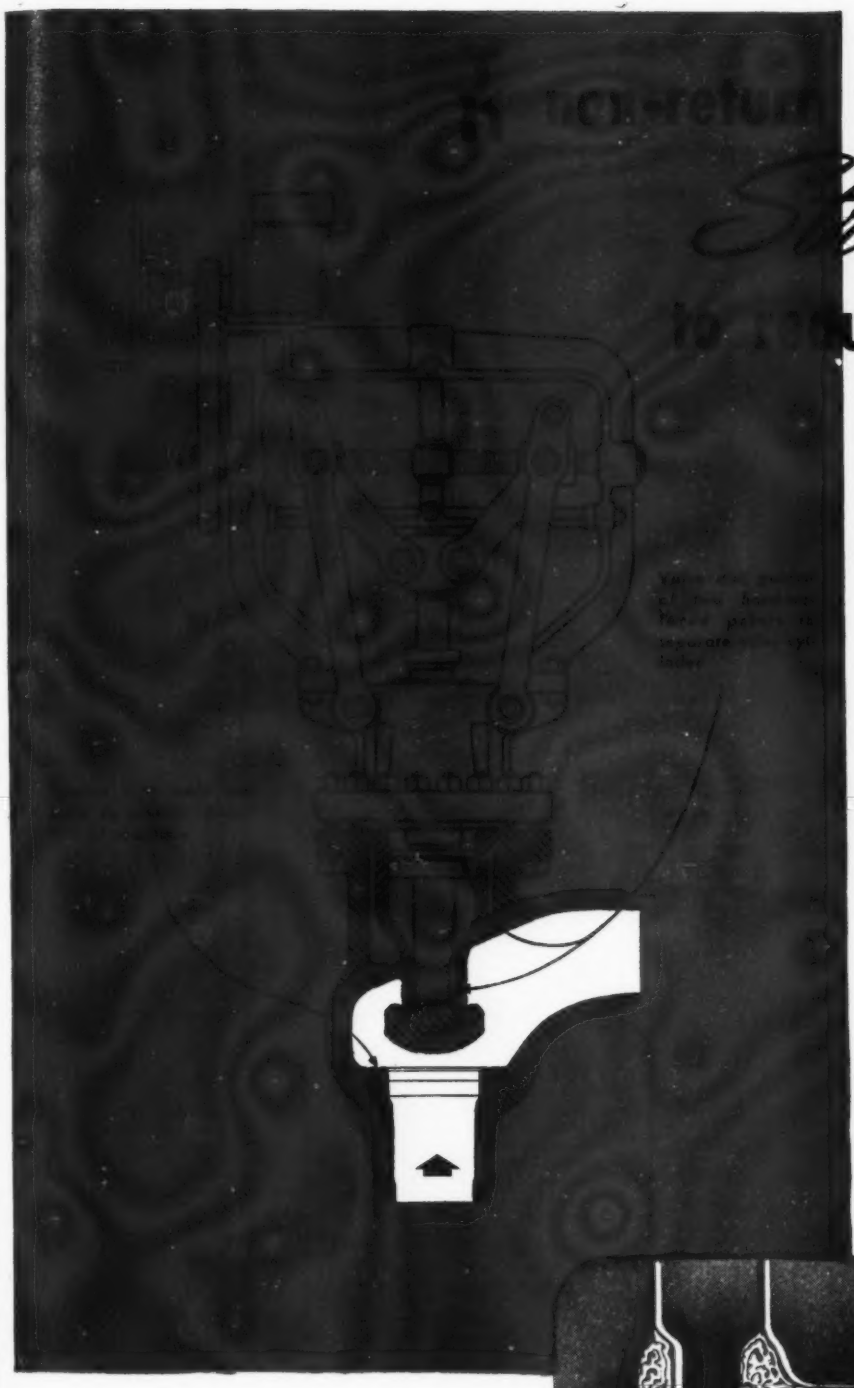


** The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN can make FLEXLASTICS.*

*** Condor V-Belts are now made in the dark, war-time color.*

KEEP AHEAD WITH MANHATTAN

THE MANHATTAN RUBBER MANUFACTURING DIVISION
OF RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES PASSAIC, NEW JERSEY

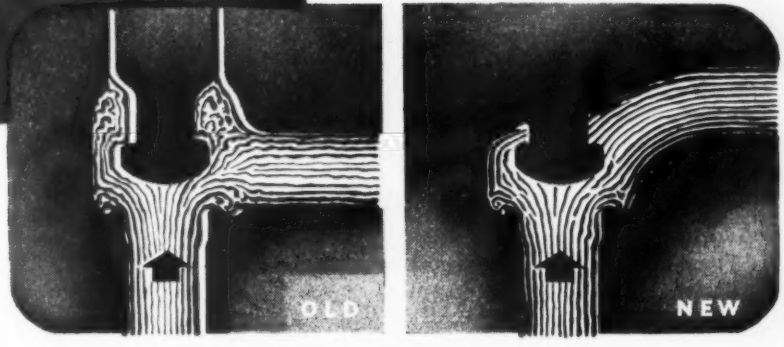


valve now *Streamlined* uce pressure loss

● Typical of SK leadership in valve engineering is the newly developed streamline valve body which reduces pressure loss to a minimum. A separate alloy cylinder having a hard-surfaced bushing is provided in the valve body to guide the disc assembly at two points assuring proper alignment, even seating and positive trouble-free operation. The double-welded seat ring includes a special isolated seal weld which eliminates possibility of distortion of the seat face.

Consult Schutte & Koerting about special high pressure valves or write for information on Boiler Non-Return Valves and Check Valves (Bulletin No. 8-B), Pressure Reducing Valves (Bulletin No. 8-R), and Turbine Valves (Bulletin No. 8).

Both angle and globe valves embody these advantages and are available in any size for pressures up to 2500 psi with toggle top, or outside screw yoke, for either hand or motor operation



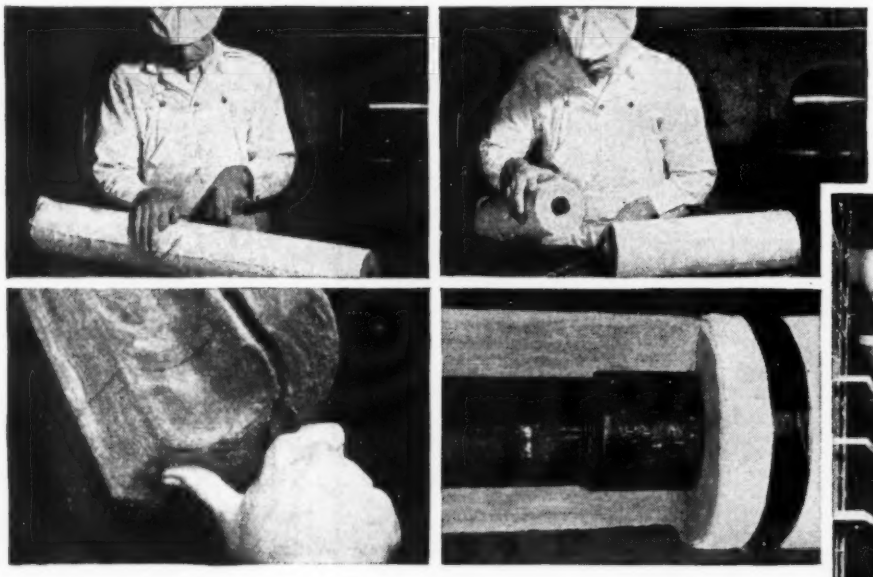
Comparison of flow through conventional valve body and the new SK Streamlined valve

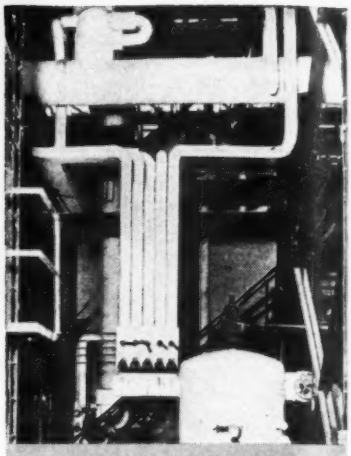
SCHUTTE & KOERTING CO. *Manufacturing Engineers*

Main Office and Works: 1150 Thompson St., Philadelphia 22, Penna.

JET APPARATUS • CONDENSERS AND VACUUM PUMPS • HEAT TRANSFER EQUIPMENT • VALVES • ROTAMETERS AND FLOW INDICATORS • GEAR PUMPS • STRAINERS • OIL BURNING EQUIPMENT • SPRAY NOZZLES AND ATOMIZERS • RADIAFIN TUBES

★ easier-faster application





PF (Pre-formed)
PIPE INSULATION

. . . another reason for using

FIBERGLAS*→

Cut it and trim it and fit it to size—installing Fiberglas PF Pipe Insulation over couplings is as easy as that.

Made in three-ft. sections, lightweight PF is easy to handle. It can be cut with an ordinary knife to form a snug fit with minimum loss of insulation thickness and efficiency. Couplings are invisible when work is finished. The fibrous ends of the sections intermesh to form tight joints.

In co-operation with the Government program to save critical fuel.

Fiberglas PF Pipe Insulation is made of fine glass fibers bonded with a thermosetting binder and molded into standard sections and segments. It is used for steam and other hot lines up to 30″ O.D. with temperatures up to 600° F.

The unusually low thermal conductivity of PF results in significant savings in heat and power. Fiberglas does not rot or decay, disintegrate or pack down under vibration. And because of its mechanical strength, this pipe covering holds its shape, withstands handling and is easily applied even on the larger pipes where three segments are used.

For complete information about Fiberglas Pipe Insulations and the many other uses of Fiberglas, write for the booklet "Fiberglas Insulations for Industry," *Owens-Corning Fiberglas Corporation, 2000 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*

FIBERGLAS INDUSTRIAL INSULATIONS

1. Blanket Type Pipe Insulation—With mesh wire on outer side to wrap around pipe and secure with wire through special edging. Manufactured in 2-ft. sections for pipes over 3″ O.D. Will withstand temperatures up to 1000° F.

2. Metal Mesh Blankets—With mesh wire or expanded metal on one or both sides. Lightweight and easily applied. 2 ft. x 4 ft. and 2 ft. x 8 ft. In standard thicknesses. Two types: For temperatures up to 600° F. and 1000° F.

3. No. 600 PF Block—Same materials as in PF Pipe Covering — in blocks 6″ x 36″ and 12″ x 36″, standard thicknesses.

4. OC-1800 High Temperature Block—A highly efficient molded block in sizes 3″ x 18″ and 6″ x 36″ and 12″ x 36″—in standard thicknesses. Will withstand surface temperatures up to 1800° F.

5. Insulating Cement—For insulating fittings, valves and all irregular surfaces. Highly efficient . . . withstands temperatures up to 1200° Fahrenheit.

6. OC Mastic Finish—An asphalt emulsion cement for insulated pipe and equipment exposed to outdoor or high moisture conditions.

7. Insulating Wool, Type TW-F—Available in bats, rolls and bulk. Used for drying-ovens, heaters, etc., for filling irregular spaces.

8. PF Insulation—Manufactured in 5 densities from 2½ to 9 lbs. per cu. ft.—standard sizes 24″ x 48″, 1″ to 4″ in thickness, according to density. For insulated panels, sound absorption and various semi-structural applications.

9. PF Roof Deck Insulation—9 lbs. density with facing to facilitate mopping. Highly efficient, with incombustible, rotproof and moisture-resistant core, for application under industrial built-up roofings. Sizes 24″ x 48″. Thicknesses from $\frac{3}{8}$″ to 2″.

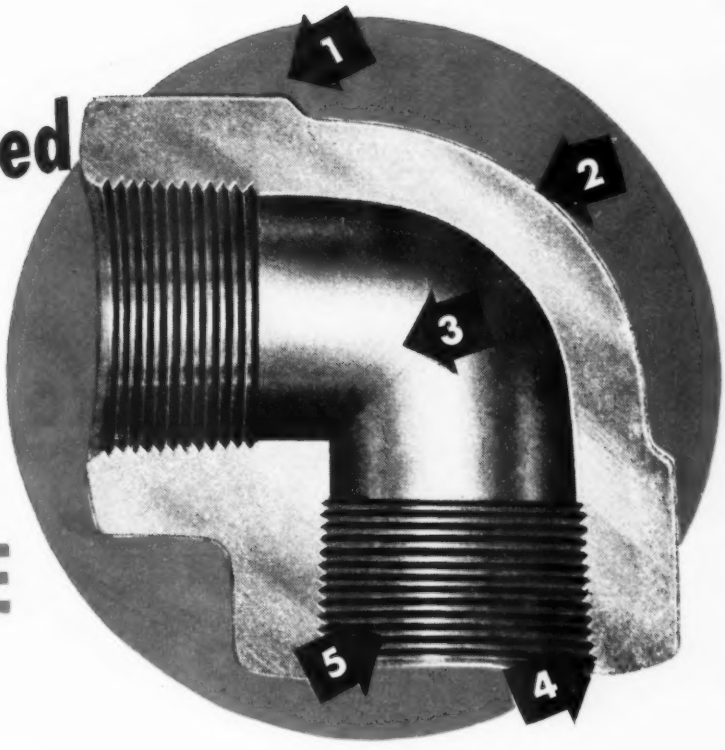
ARMY (E) NAVY

FIBERGLAS

*Trade Mark Reg. U. S. Pat. Off.

INDUSTRIAL INSULATIONS

Time Tested and Performance Proved



FORGED STEEL SCREW END PIPE FITTINGS

AVAILABLE IN 2000–3000 AND 6000 POUND CLASSES FOR OIL–GAS–STEAM–AMMONIA AND HYDRAULIC SERVICE

• W-S Forged Steel Fittings are especially recommended for High Pressure, High Temperature Service in refineries, oil fields, chemical plants, shipyards, air conditioning and refrigeration plants, power plants and all hydraulic services.

WHY W-S FITTINGS ARE PREFERRED

1. Long low bands extending beyond thread provide strength where necessary to insure tight joints as well as ample wrench surface for easy installation.

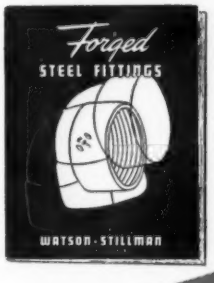
2. A high safety factor is insured through heavy walls of uniform thickness.

3. Unrestricted flow is provided by passages greater in area than the pipe of equivalent size.

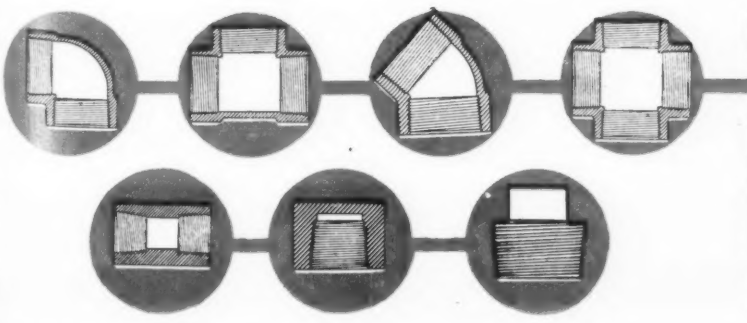
4. All Fittings are chamfered to protect the thread and afford easy entrance of the pipe.

5. Threads are long, accurately cut—perfectly aligned insuring tight joints.

W-S Forged Steel Screw End Fittings are machined from solid drop forgings. Available in three classes—2000—3000—and 6000 pound. Sizes ¼" to 4" I. P. S. Each class can be furnished in Carbon Steel; Carbon-Molybdenum Steel; Chromium-Molybdenum, Steel or Stainless Steel. Ask for Bulletin A-3. The Watson-Stillman Co., Roselle, New Jersey.

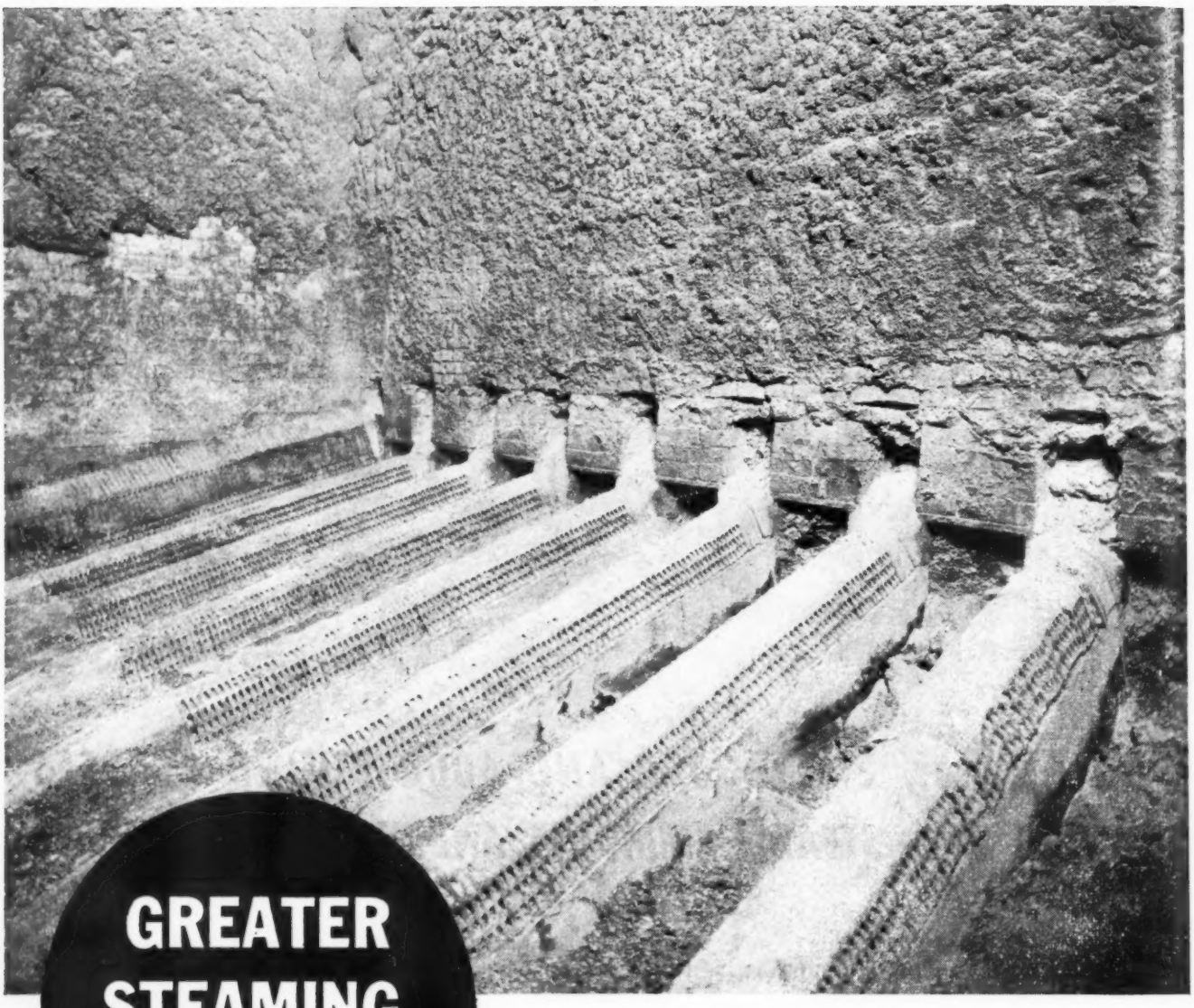


Sold Through Leading Distributors



WATSON-STILLMAN

DESIGNERS AND MANUFACTURERS OF FORGED STEEL FITTINGS, VALVES AND HYDRAULIC EQUIPMENT



GREATER STEAMING CAPACITY-

assured with "CARBOFRAX" brick-protected settings

The full grate area is always maintained with "CARBOFRAX" silicon carbide brick installed in the clinker zone of boiler furnaces.

There is no softening of these bricks. They stay hard and dense even at abnormally high temperatures. They are impenetrable to clinkers, so massive formations that restrict the fuel bed simply cannot build out on the "CARBOFRAX" brickwork.

Free from choking clinkers, the fire is more active—better combustion is obtained—greater efficiency is secured. Maximum steam production is the result.

Consider this and the additional information provided in the booklet "'CARBOFRAX' in Boiler Furnaces." Write today for your copy. The Carborundum Company, Refractories Division, Dept. J1, Perth Amboy, N. J.

"CARBORUNDUM" and "CARBOFRAX" are registered trade marks of, and indicate manufacture by, The Carborundum Company.

Super Refractories by CARBORUNDUM TRADE-MARK

a NEW *Industrial* POWER TUBE *by* Federal

TECHNICAL DATA FOR TYPE F-5303

Filament Voltage	11.0 volts
Filament Current	27.5 amps.
Maximum Ratings for Maximum Frequency of 50 Mcs.	
DC Plate Voltage	3500. volts
DC Plate Current	1.0 amp.
Plate Dissipation	1200 watts
Overall Height	app. 7"
Maximum Diameter	3⅛"

Supplied with 6" flexible copper leads, 2 on each terminal.

Type of Cooling . . . . . Forced-air
(Also supplied for water-cooling, type F-5302.)

Federal presents a new and rugged power tube that fills an immediate demand — a power tube that has been *specially* designed for industrial use in high-frequency heating equipment, both dielectric and induction.

Really built to withstand the constant jars, shocks, and vibration commonly encountered in manufacturing operations, this heavy-duty vacuum tube is very conservatively rated, and will stand up under extremely hard usage.

Widely spaced, unusually sturdy filament and grid elements, without internal ceramic insulation, give this tube a ruggedness that makes it the logical choice for dependability in the design of industrial heating equipment.

For industrial power tubes, and also for rectifier and transmitting tubes, see Federal first... because "Federal always *has* made better tubes."

FEDERAL TELEPHONE & RADIO FTR

Federal Telephone and Radio Corporation

An IT&T Associate

Newark 1, New Jersey

It's what goes on INSIDE that counts

Inside an engine, extra flat piston rings deliver important savings

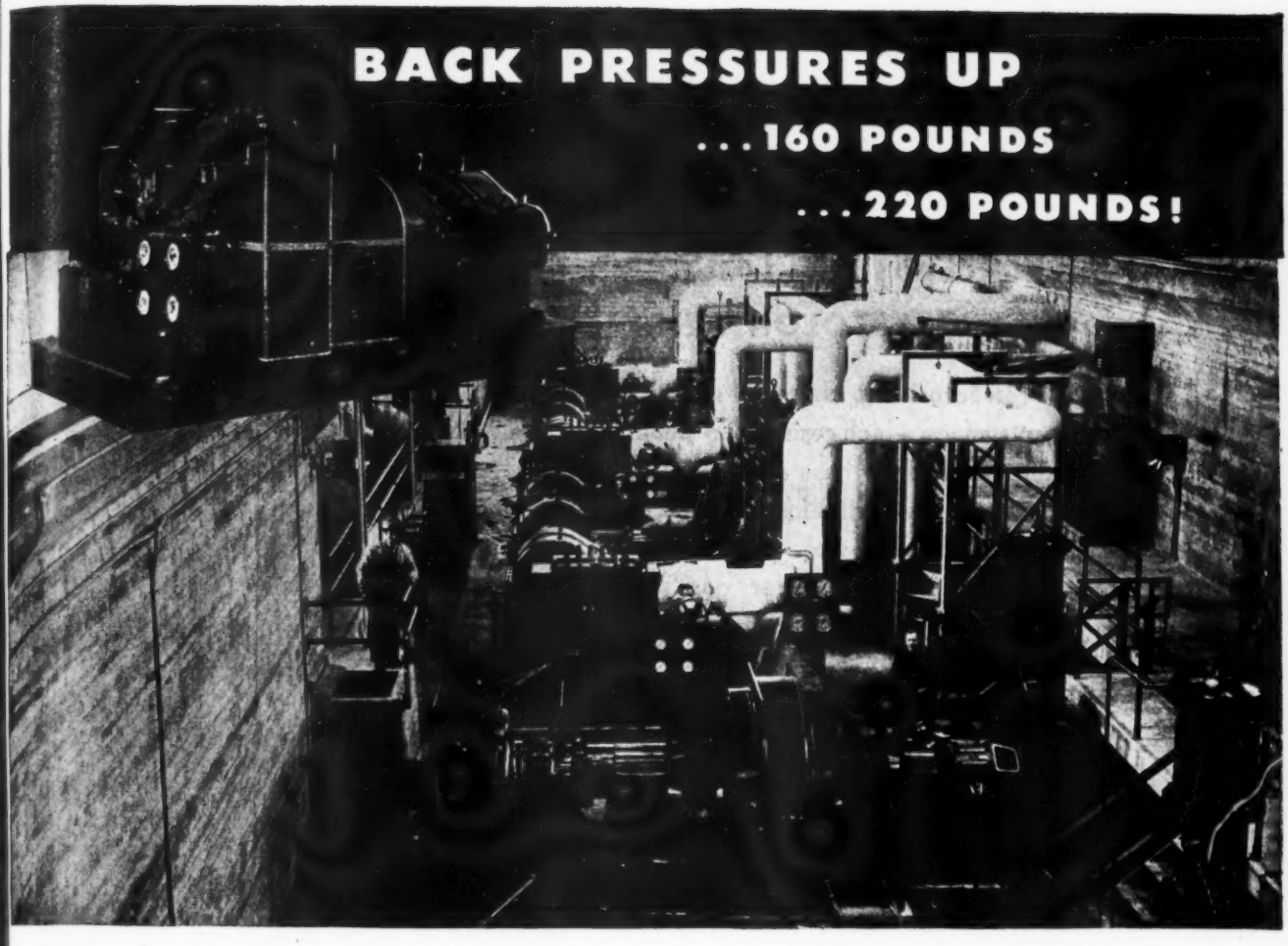
THE FLATTER the ring, the better the seal—and Pedrick rings are so flat that small 2-inch rings can be stacked 6 feet high without tottering, as shown in illustration. It is this kind of precision in each manufacturing operation that enables Pedrick rings to deliver important savings in fuel . . . more power . . . and longer wear.

Furthermore, Pedrick rings stay flat in spite of severe service conditions. Pedrick has developed an exclusive and patented Heat-Shaping process that relieves the stresses set up in the metal by machining operations. Each grain in the metal is set for ring life. There is no distortion or warping in service.

These are some of the reasons why Pedrick *precisioneered* piston rings deliver better performance *inside* an engine. Diesel operators in every field have found from actual experience that Pedrick rings deliver many extra hours of trouble-free service . . . give better compression . . . and save fuel. WILKENING MANUFACTURING Co., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

BUY WAR BONDS
AND MORE BONDS

Pedrick
precisioneered PISTON RINGS



Result: Lowest power costs at new synthetic rubber plant with Worthington-Moore turbines

In Canada's new government-owned synthetic rubber plant, operated by Polymer Corporation, Ltd., Worthington-Moore high back pressure steam turbines have permitted considerable savings in power costs. In this, Canada's largest steam plant installation, engineered by H. G. Acres and Company, power is produced as a by-product, since all exhaust steam is used for plant operation.

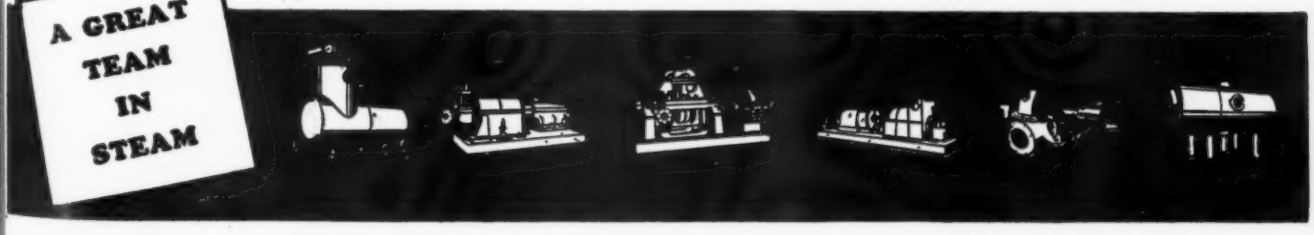
Three Worthington-Moore 1650-hp. geared multi-stage turbines are illustrated above as installed. These topping turbines operate with steam at 400 lbs. initial pressure, 650°F. temperature, and exhaust against 160 lbs. back pressure. Two 1000-hp. Worthington-Moore turbines, exhausting to 220 lbs. back pressure, were also selected.

Save Money in Modernizing Steam Plants

Worthington-Moore turbines operating against unusually high back pressures have enabled many plants to install modern high-pressure boilers without scrapping existing low-pressure apparatus. Write for complete details. *Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, New York.*

WORTHINGTON *BEHIND THE NAME*
MOORE

MR4-7



For a Refractory That Lasts—

—CRYSTOLON BRICK

Great refractoriness, chemical stability and dense surface which resists slag penetration and abrasion—these are the qualities which account for the long service of CRYSTOLON Brick in stoker-fired boiler furnaces, generators of water gas sets and combustion chambers of high temperature furnaces.

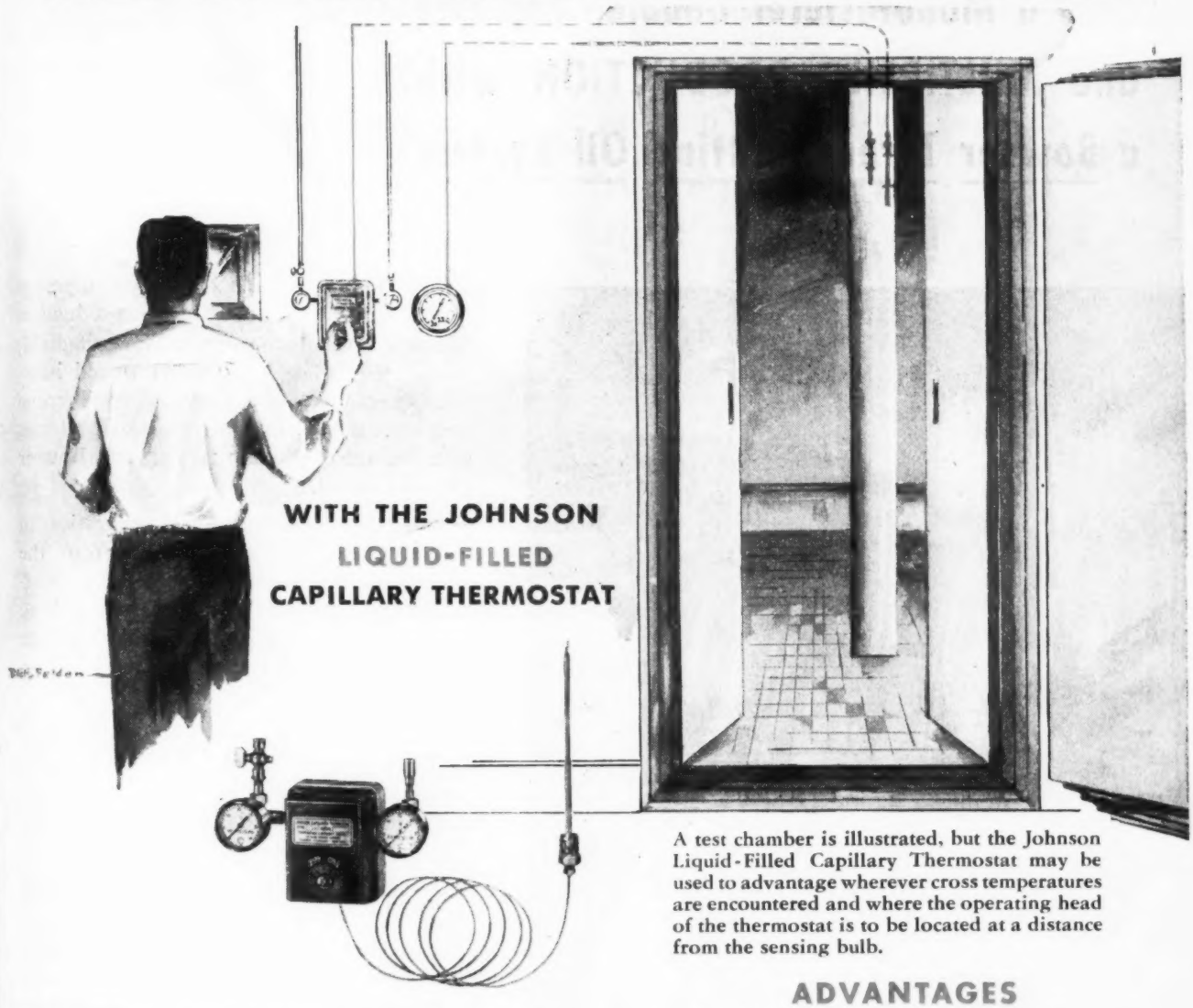
These brick resist both the chemical and physical action of molten slag and those few clinkers which do adhere are easily removed leaving the surface of the brick clean and unaffected for further long life and economical operation.

NORTON COMPANY
WORCESTER 6 MASSACHUSETTS

NORTON REFRACTORIES

THE ADVANTAGES ARE YOURS

WHEN YOU SOLVE CROSS TEMPERATURE PROBLEMS



WITH THE JOHNSON
LIQUID-FILLED
CAPILLARY THERMOSTAT

A test chamber is illustrated, but the Johnson Liquid-Filled Capillary Thermostat may be used to advantage wherever cross temperatures are encountered and where the operating head of the thermostat is to be located at a distance from the sensing bulb.

WHERE regulated temperatures must cross above and below normal room temperatures, it is usually desirable to locate the operating head of a thermostatic control system at a distance from the sensing bulb. The ideal way to solve this troublesome problem is with the Johnson Liquid-Filled Capillary Thermostat which is only one instrument in a complete line of temperature control devices designed, manufactured and installed by Johnson. For full details of how this apparatus can help solve your cross temperature control problem, get in touch with the Johnson branch nearest you. There is no obligation, of course.

ADVANTAGES

- **Wide range of temperatures, −30° to +300° F.**
- **Uniform dial graduations**
- **Not affected by ambient temperatures**
- **Extremely small thermometric lag**
- **Practically no mechanical lag**
- **Not affected by static head**

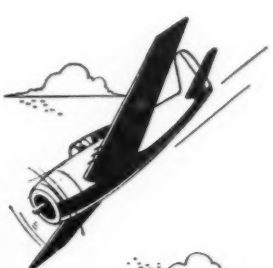
JOHNSON

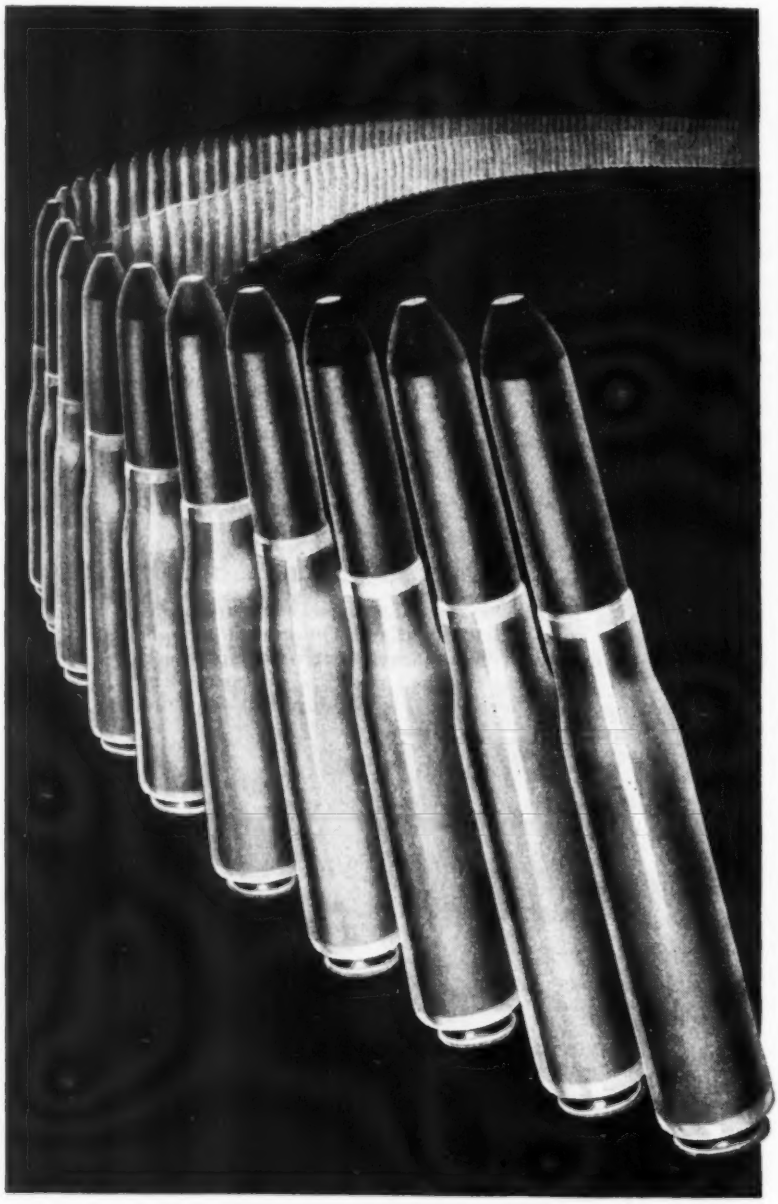
Fuel-Saving Starts With CONTROL

Automatic TEMPERATURE AND AIR CONDITIONING *Control*

JOHNSON SERVICE COMPANY, MILWAUKEE 2, WISCONSIN • DIRECT BRANCHES IN ALL PRINCIPAL CITIES

How a Manufacturer Doubled Tap Life and MULTIPLIED PRODUCTION with a Bowser Thread Cutting Oil System





From metal vaults and cemetery equipment to 20 mm shells . . . that's the production switch The Champion Company, Springfield, Ohio, made when Uncle Sam needed help. That's about as broad a jump as you'll come across . . . but Champion made it in stride, with the aid of modern tooling and Bowser Liquid Control.

Tapping is, of course, a major operation in making shells, and high output from the tappers is vital. But steel particles in the cutting oil of Champion's tappers were dulling taps too quickly, causing excessive rejects due to poor threads, and continually causing down time on the machines.

Then a Bowser Pressure Filter was installed and, in the words of a Champion executive, "We cut our tap requirements in half, got a better thread and had practically no down time on our machines."

Power plant operators are, of course, well acquainted with Bowser Lubrication Systems, Turbine Oil Conditioners, Force Feed Lubricators, and other Liquid Control units. Here's an example of Bowser Turbine Oil Conditioner performance: In a leading steel plant, it lowered the acid number of the oil from .0561 to .021 within ten days after installation. What's more, the reconditioned oil showed even less acid than the new oil added at the time of installation. Frequent bearing failures were stopped and the average oil temperature was reduced by 51°F. Only a little make-up oil is now added periodically—no batches are ever dumped.

A Bowser engineer will gladly consult with you. Write today. BOWSER, INC., Dept. 2-B, Fort Wayne 2, Indiana.

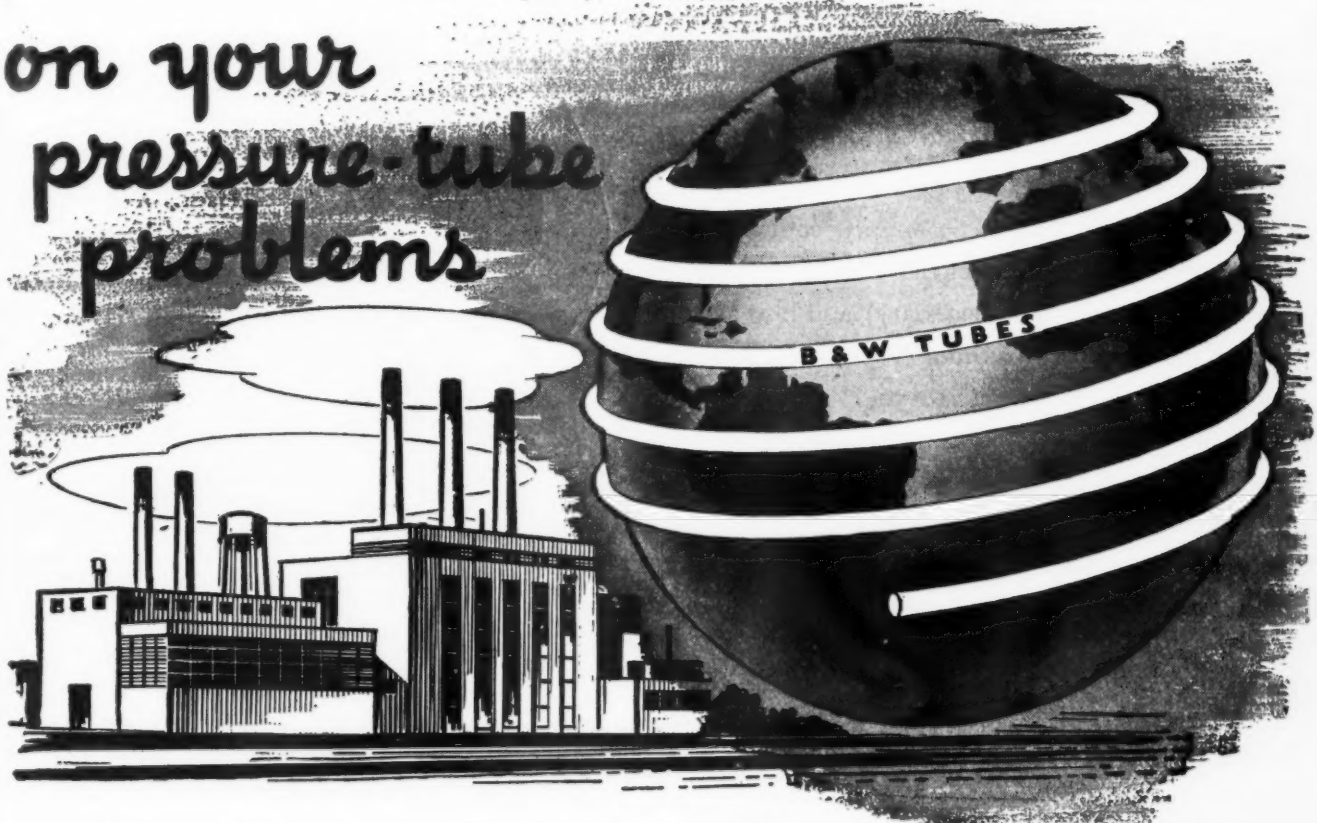
Not only has Bowser's war production earned the Army-Navy E... Bowser equipment has helped earn it for scores of other companies.

BOWSER ESTABLISHED 1885

THE NAME THAT MEANS **EXACT CONTROL** OF LIQUIDS

Get this 700 MILLION FEET OF EXPERIENCE . . .

on your pressure-tube problems



No manufacturer can produce enough pressure tubing to reach nearly 5½ times around the earth without acquiring a lot of valuable first-hand information on what it takes to match tubes to jobs for utmost dependability and economy under all kinds of operating conditions. This is just one way of measuring the experience that goes into the making and applying of every B&W Tube for steam generating and heat transfer equipment. It is reflected in their consistently uniform quality and dimensional accuracy and enviable performance service record in all types of equipment.

At B&W you get unbiased technical advice on pressure tubing requirements for B&W can furnish BOTH Seamless and Welded Tubes. In fact, nearly 20,000,000 feet of *welded* pressure tubing alone was supplied by B&W during the past 12 months.

Why not take advantage of B&W's wealth of experience, modern specialty tube mills and extensive research facilities next time you need pressure tubing?

B&W MAKES BOTH

B&W TUBES

ELECTRIC-RESISTANCE WELDED
Carbon steel grades
Sizes: ⅜ in. to 4 in. O.D.

SEAMLESS
Complete range of carbon, alloy and stainless steels
Sizes: ½ in. to 8⅝ in. O.D.

THE BABCOCK & WILCOX TUBE COMPANY

WELDED TUBE DIVISION
ALLIANCE, OHIO

SEAMLESS TUBE DIVISION
BEAVER FALLS, PA.

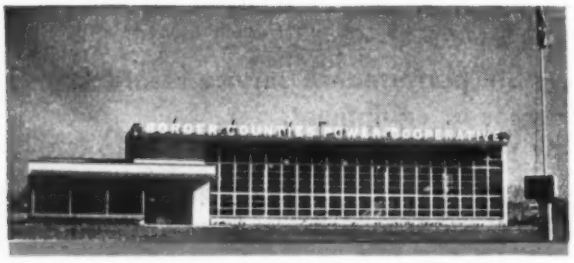
BA-1298

HOW TO PUT WASTE HEAT TO WORK

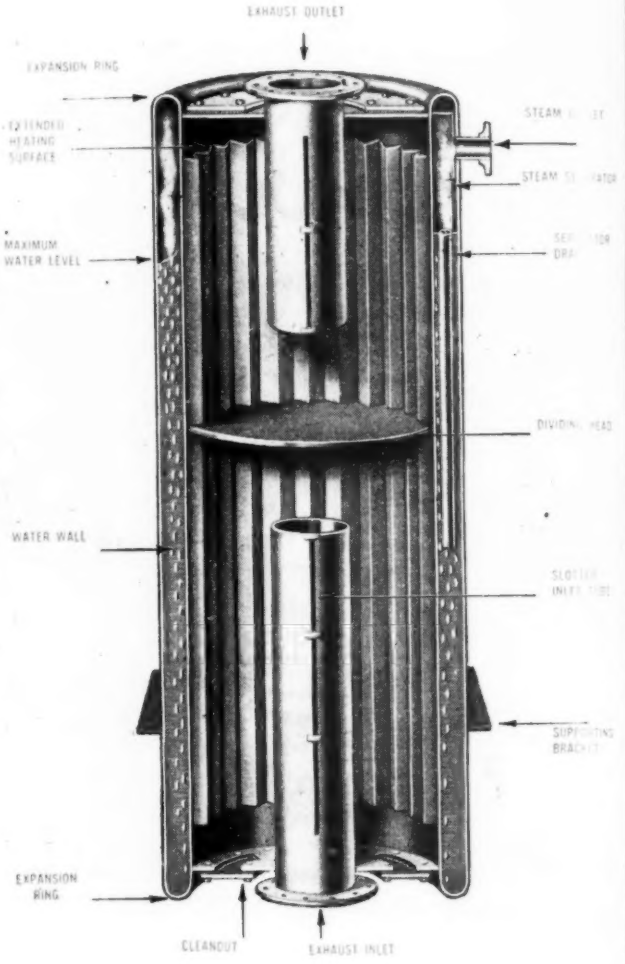
WITH MAXIM HEAT RECOVERY SILENCERS

Engine exhaust heat, all too often wasted, can be put to good and profitable use through Maxim Heat Recovery Silencers. With these specially constructed silencers extra steam or hot water for heating or processing operations is obtained *without extra fuel cost* as the heat source is simply engine exhaust heat. Thus in one unit effective exhaust silencing, spark arresting (where necessary) and heat recovery are combined for maximum operating efficiency. Such a saving, important to your balance sheet at any time, is doubly important where fuel supplies are difficult to obtain.

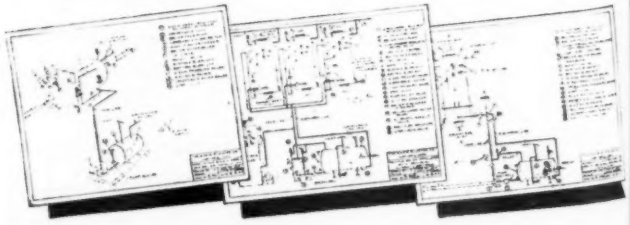
The power plant below located in northern Minnesota is heated entirely through the use of Maxim Heat Recovery Silencers.



For silencing, without the heat recovery feature, Maxim makes silencers for internal combustion engine exhaust or intake, steam engine exhaust, air compressor intake, vacuum pump discharge, blower intake and discharge, high velocity steam, air or gas discharge. Engine exhaust silencers available with or without spark arrestor. Bulletins on request.



PRACTICAL WORKING HOOK-UPS



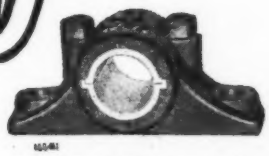
The Maxim Engineering Department has prepared several drawings of typical Heat Recovery Silencer hook-ups. These are available with a detailed discussion of each hook-up. We will be glad to send them to you. Just ask for Dwgs. B-298, B-301, B-302 and B-303.

ARMY E NAVY

MAXIM

THE MAXIM SILENCER CO. • 92 HOMESTEAD AVE., HARTFORD, CONN.

Jeffrey Parts FOR BETTER POWER PLANT OPERATION

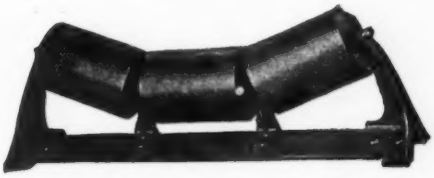


Transmission Bearings, Take-Ups, Gears, Pulleys, Clutches

Malleable Iron or Steel Buckets for every type elevator

Chains and Sprockets for Elevating, Conveying and Driving Service

Spiral Conveyor Flights and Fittings

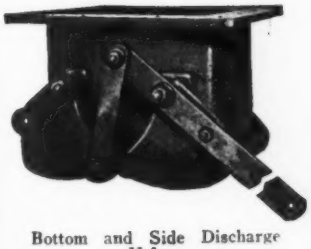


Roller, Ball or Plain Bearing Belt Idlers in all standard widths

In the maintenance of power service you will do a better job at lower cost with Jeffrey replacement parts.

Illustrated are a few of the Standard parts made by Jeffrey to help you maintain dependable, efficient power service.

Save time—trouble—and continuous expense—specify Jeffrey.



Bottom and Side Discharge Valves

JEFFREY COMPLETE UNITS FOR THE POWER PLANT

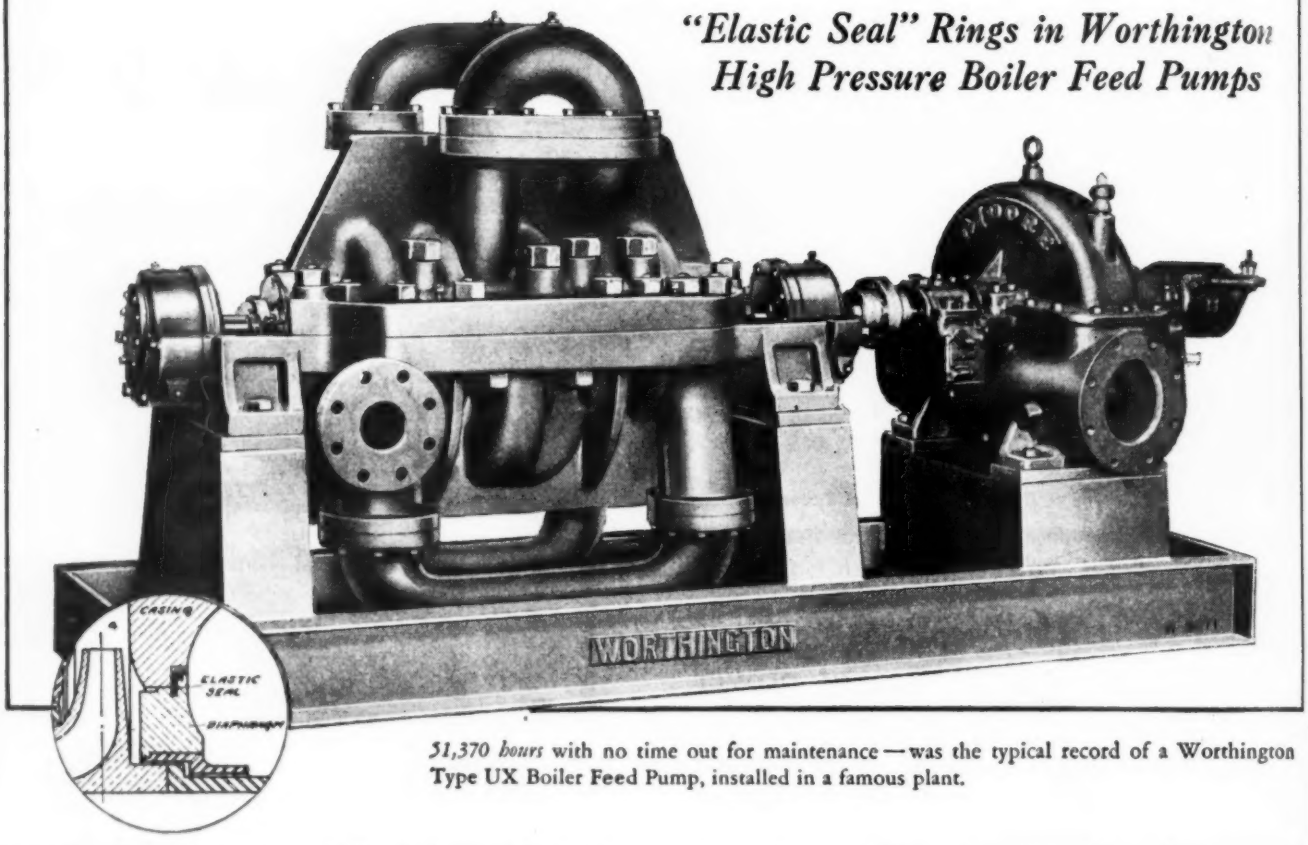
TRACK HOPPERS • FEEDERS
ELEVATORS • CONVEYORS
SKIP HOISTS • WEIGH LARRIES
CRUSHERS

THE JEFFREY MANUFACTURING COMPANY
(ESTABLISHED IN 1877)
932-99 NORTH FOURTH STREET • • COLUMBUS 16, OHIO

SALES OFFICES: Baltimore 1, Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 13, Denver 2, Detroit 13, Harlan, Houston 5, Huntington 19, Milwaukee 11, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 3, Salt Lake City 1, Scranton 3

THEY TIGHTEN THEIR OWN JOINTS TO MAKE HIGH PRESSURE SAFER

"Elastic Seal" Rings in Worthington High Pressure Boiler Feed Pumps



51,370 hours with no time out for maintenance — was the typical record of a Worthington Type UX Boiler Feed Pump, installed in a famous plant.

First to build high pressure boiler feed pumps in the U. S. (the first pump above 1200 p.s.i. was installed in 1923), Worthington has continued to advance centrifugal pump design. The Worthington Elastic Seal Ring is only one example.

Eliminates common cause of pressure loss. Inter-stage cutting, a serious danger in all boiler feed pumps with horizontally-split casings, becomes even more serious as pressures increase. The Worthington Elastic Seal Ring — flexible, resilient — seals rigid interstage diaphragms against rigid casings, so that the resulting joints are liquid tight.

Initial seating assured by the flexibility of the seal ring.

The higher the pressure, the tighter it gets. The Elastic Seal Ring is so arranged that the pressure developed in each stage tends to seat each joint more tightly.

Investigate — today — the many other advantages of Worthington's type UX centrifugal pumps for high pressure boiler feeding radially and axially balanced — with the interstage loops representing the best in hydraulic design — freedom from thrust and stuffing box troubles — absence of shaft vibration — low power and maintenance costs. Telephone to your nearest of our 24 District Offices, or write us, *Worthington Pump and Machinery Corporation, Harrison, N. J.*

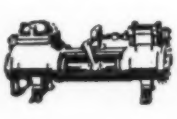
MEMBER HYDRAULIC INSTITUTE U.S.A.

WORTH BEHIND THE NAME
WORTHINGTON

CP4-23

THE WORLD'S LARGEST MANUFACTURER OF PUMPS

Steam



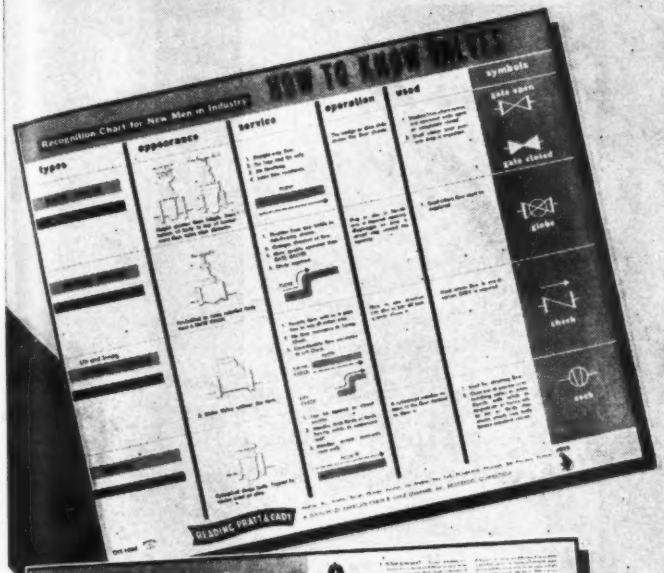
Power

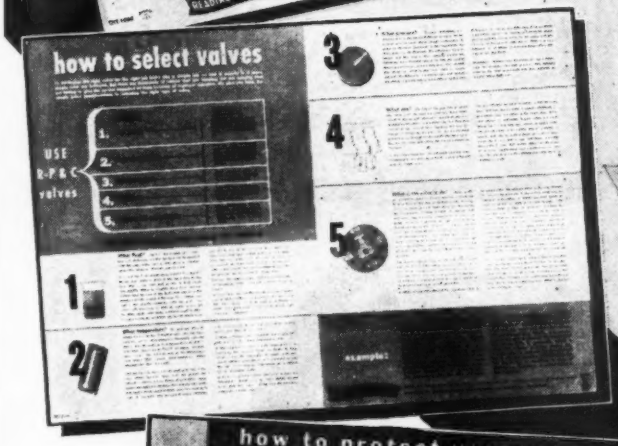
Rotary

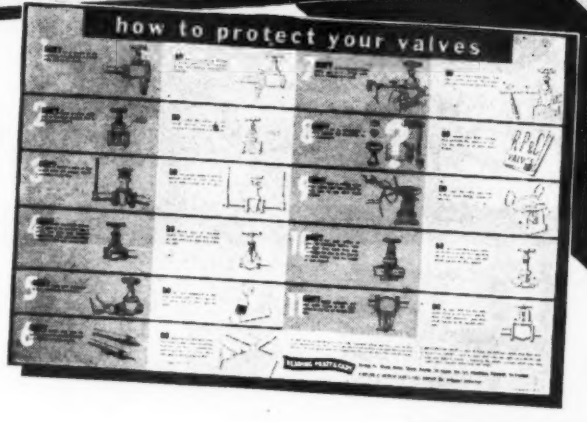
Vertical Turbine

Centrifugal

So that valves may *Serve* you better



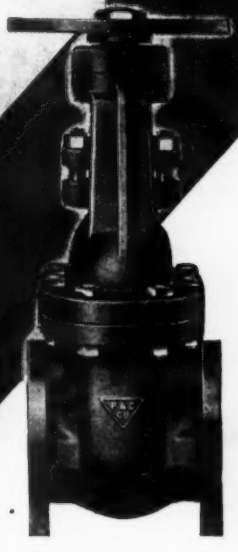




NOT only good valves, but best possible valve service—that's the **R-P&C** idea. A valve can do its best only on the job for which it was designed—and then only if correctly installed and properly used.

There is a good **R-P&C** valve for practically any job. And there is an **R-P&C** expert ready to advise on any valve question. However, if your problems are simple ones, perhaps the answers may be found on one or another of the charts shown on this page.

Thousands of these charts have been requested and received by valve users. If you do not have them, we will send you one or a complete set. Apart from their practical everyday use, they will remind you of a source for good valves and expert valve information.



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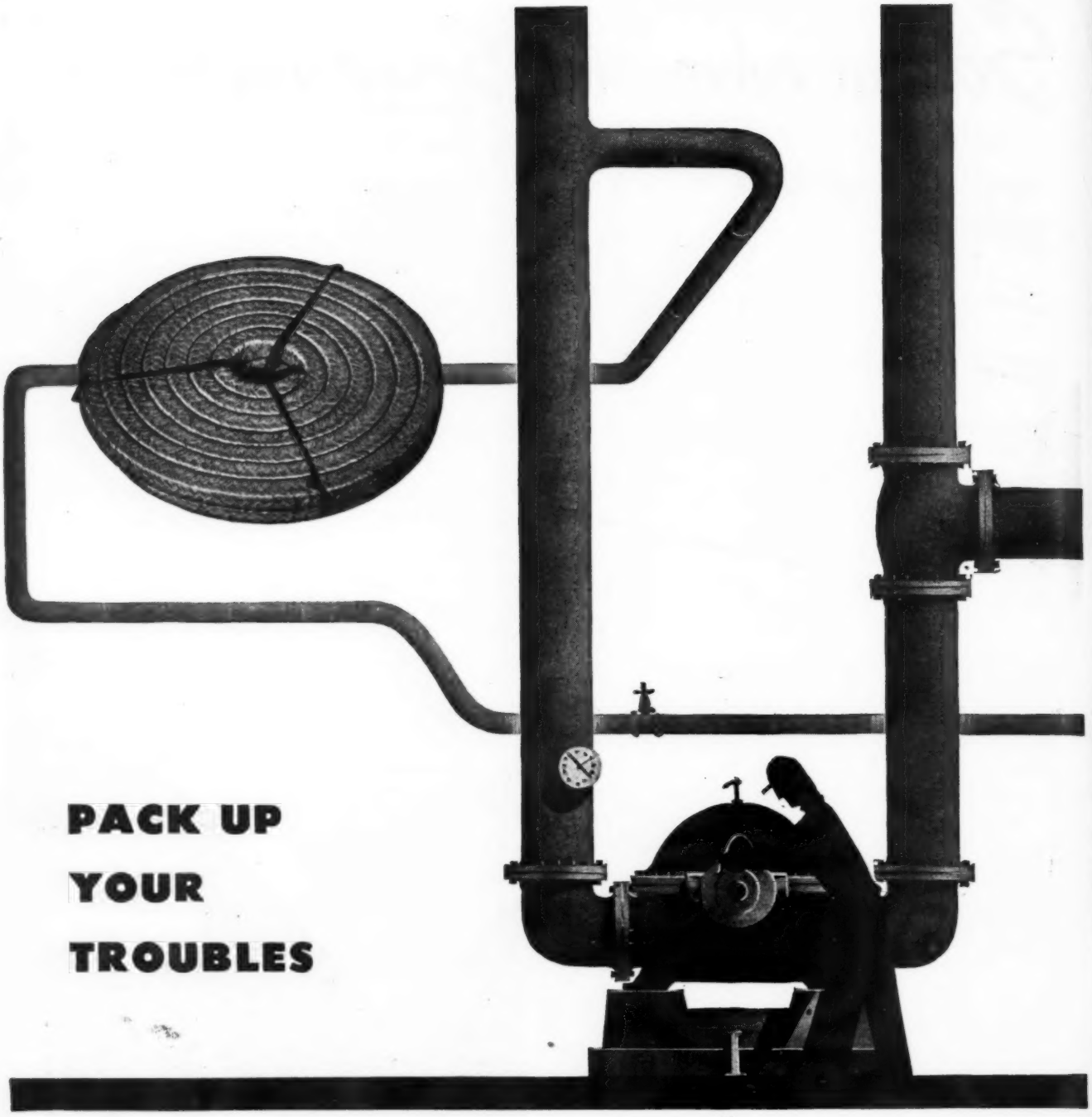
MANUFACTURERS OF
READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

ACCO Reading, Pa., Atlanta, Boston, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

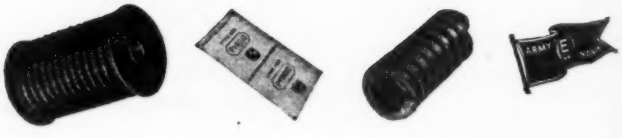
READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE • BRIDGEPORT



PACK UP YOUR TROUBLES

WHEN YOU USE R/M, you can pack up your packing troubles for keeps. . . . R/M makes 73 different types of packing, each in a number of different sizes . . . rings, spirals, wicks, coils, sheets, spools, tubes, gaskets, bulk . . . packing for pumps, valves, compressors, flanges, hydraulic cylinders, steam engines, man-holes, all industrial uses . . . for temperatures to 1200° F. . . . for pressures to 5,000 pounds . . . a complete, reliable, time-tested line . . . and all one quality. . . . Specify R/M packings now at your distributor's. IT'S "PACKED WITH SATISFACTION"—WHEN YOU USE R/M.

PACKINGS FOR EVERY INDUSTRIAL USE



INDUSTRIAL SALES DIVISION

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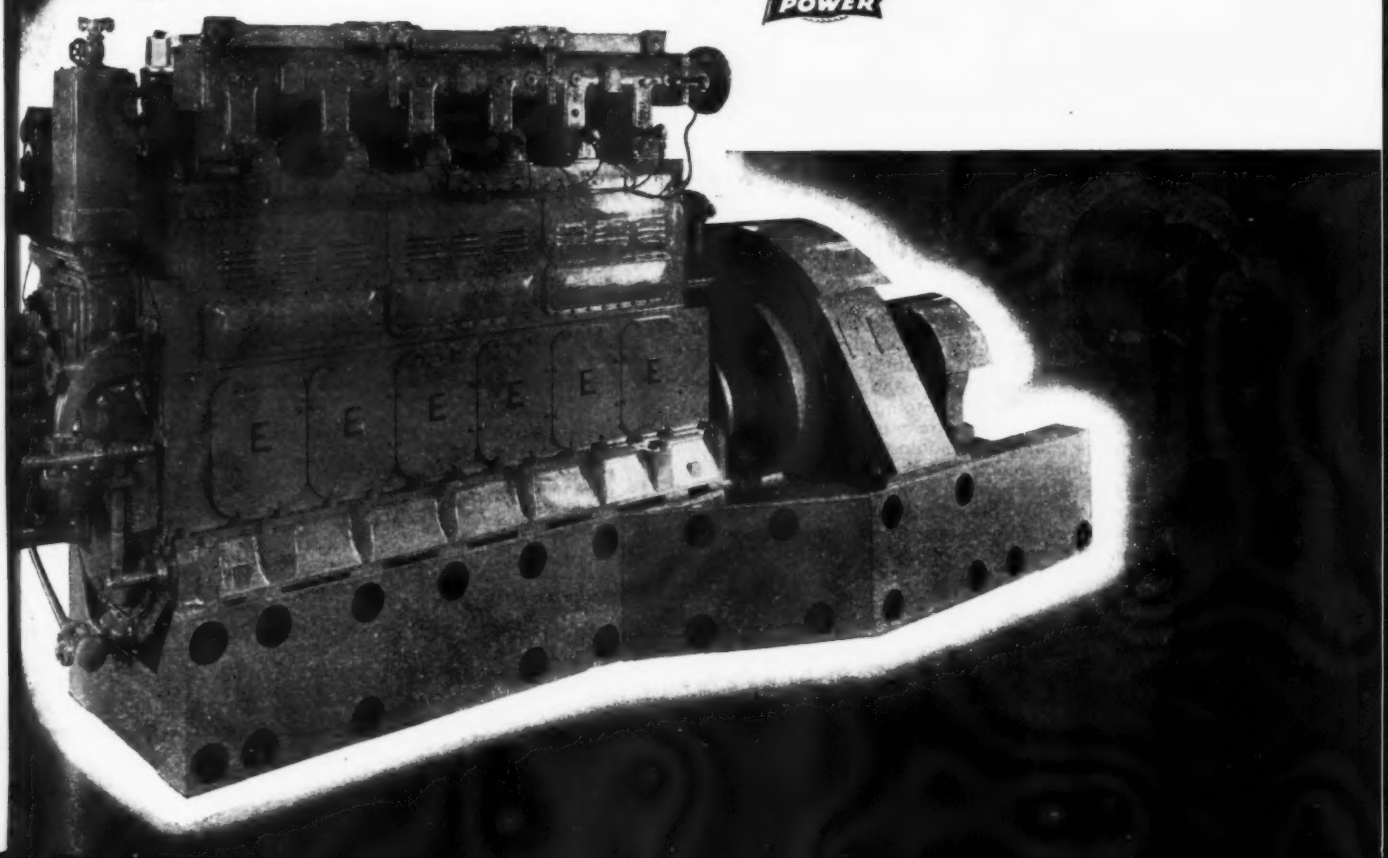

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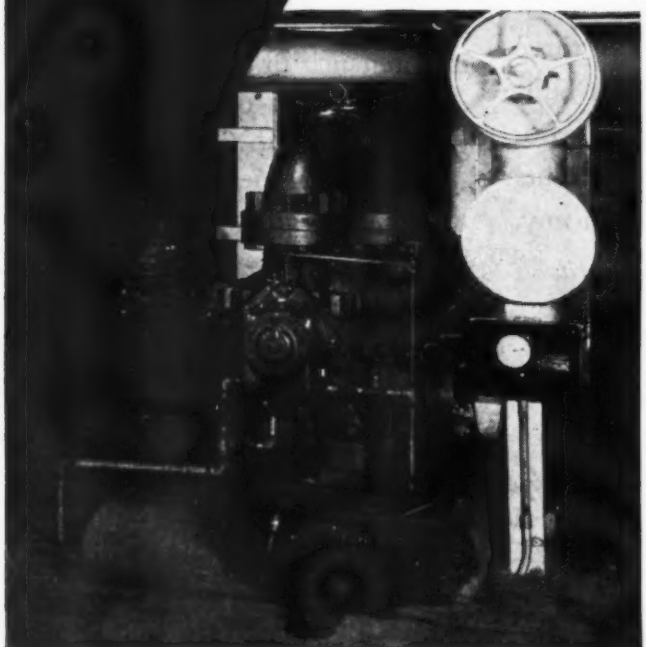

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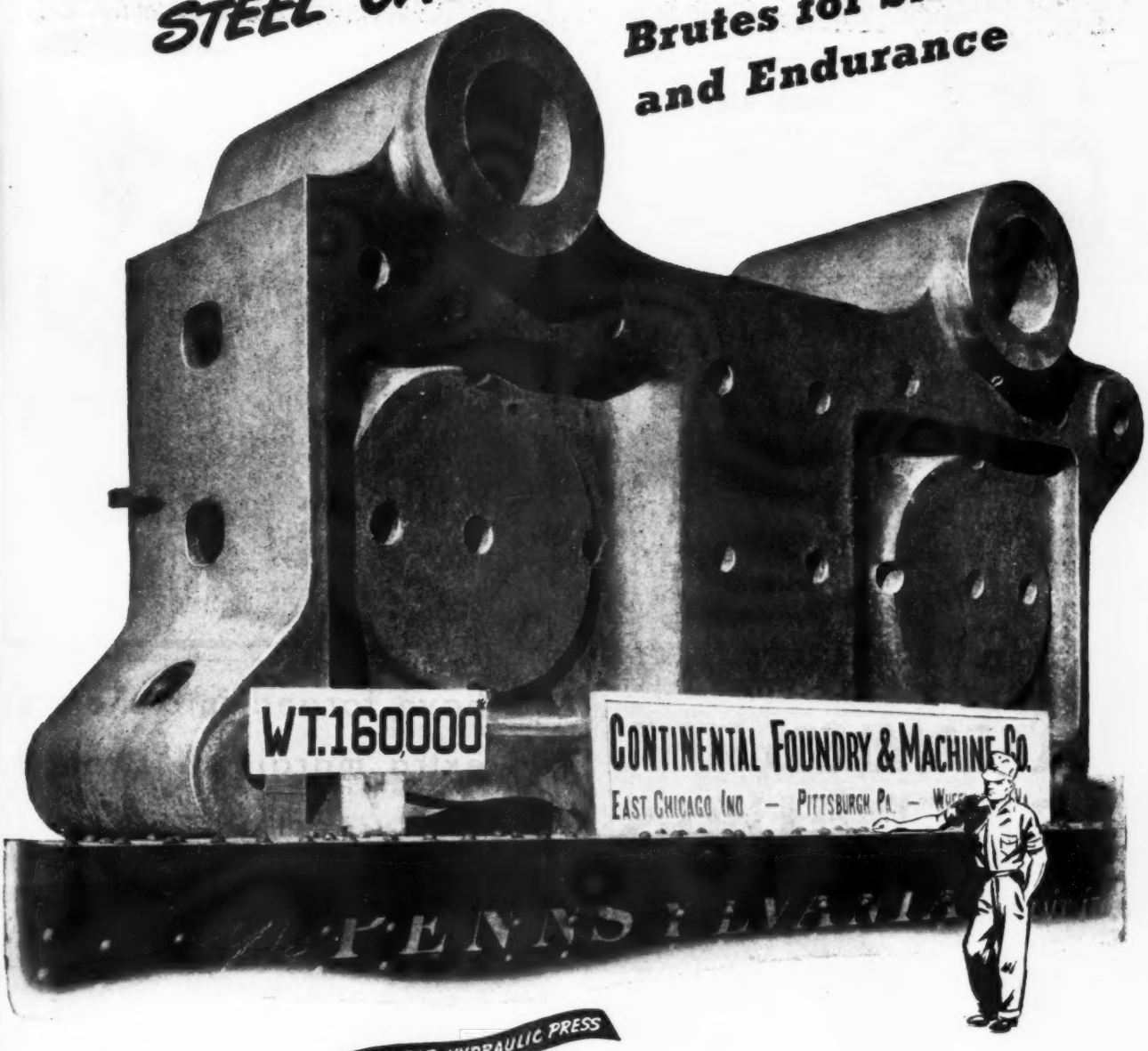

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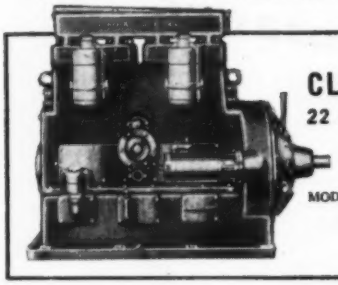

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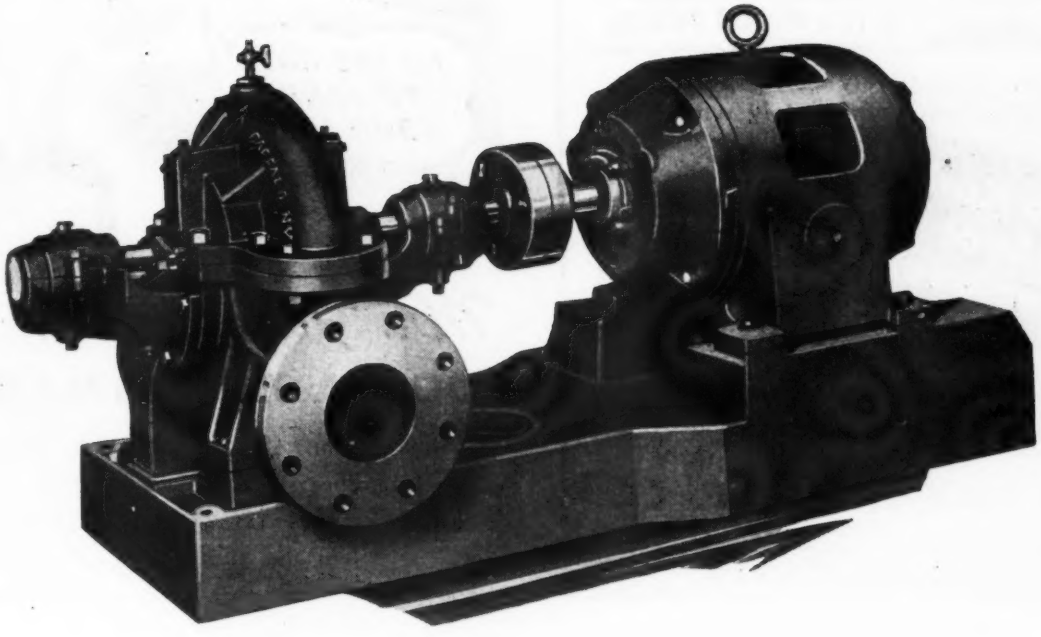

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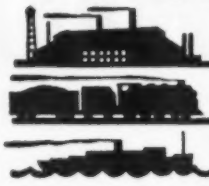

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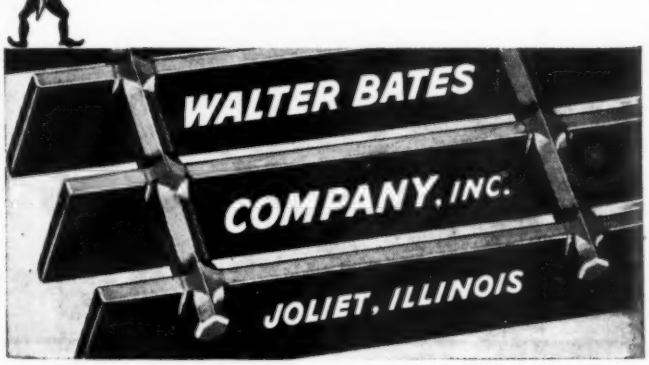

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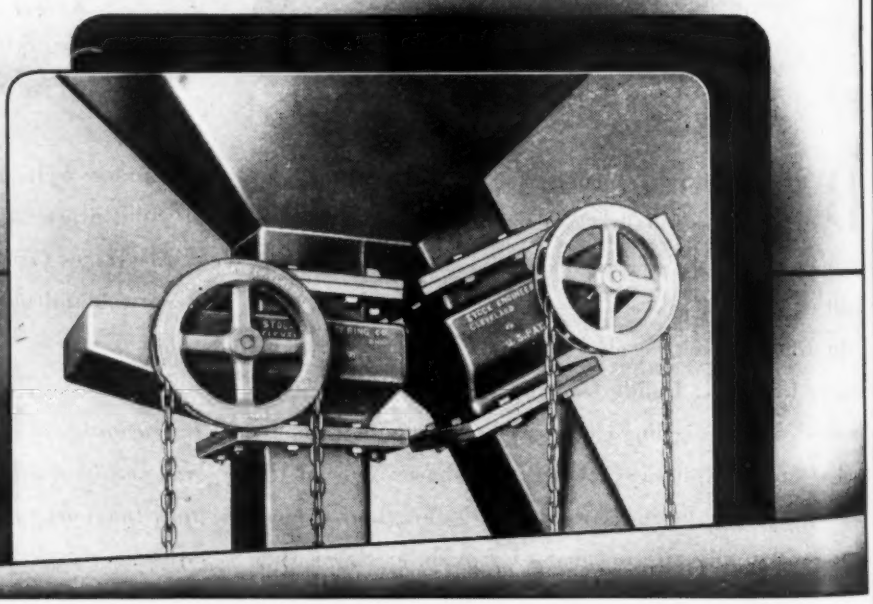

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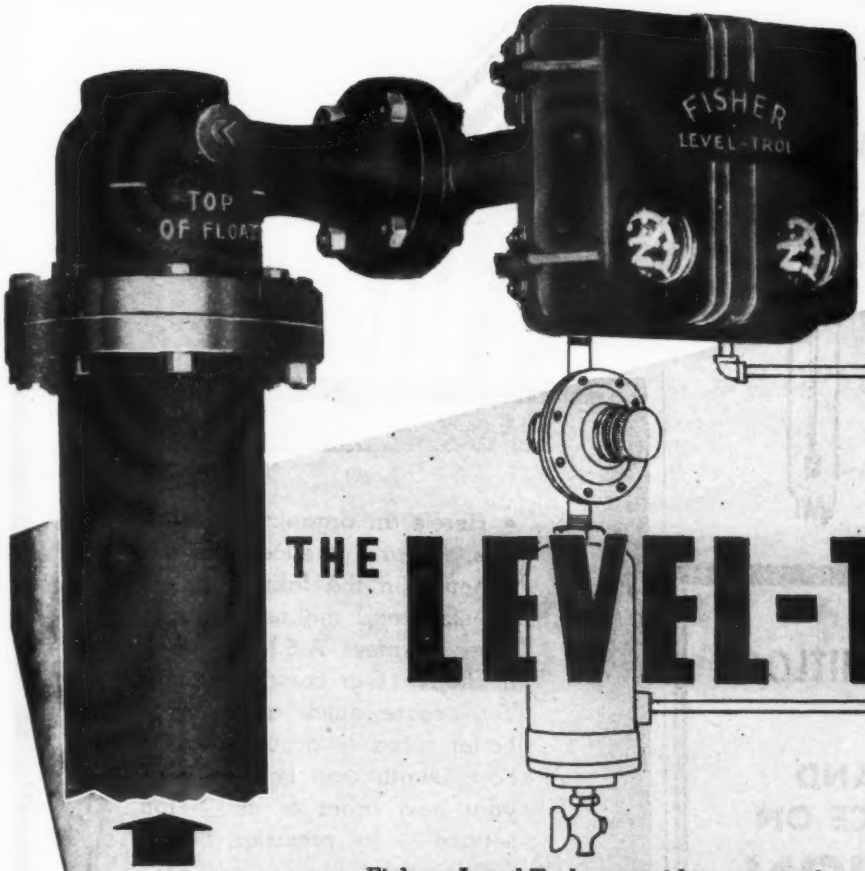

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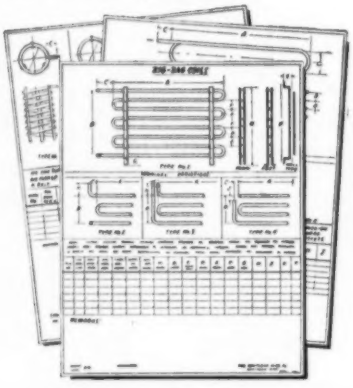

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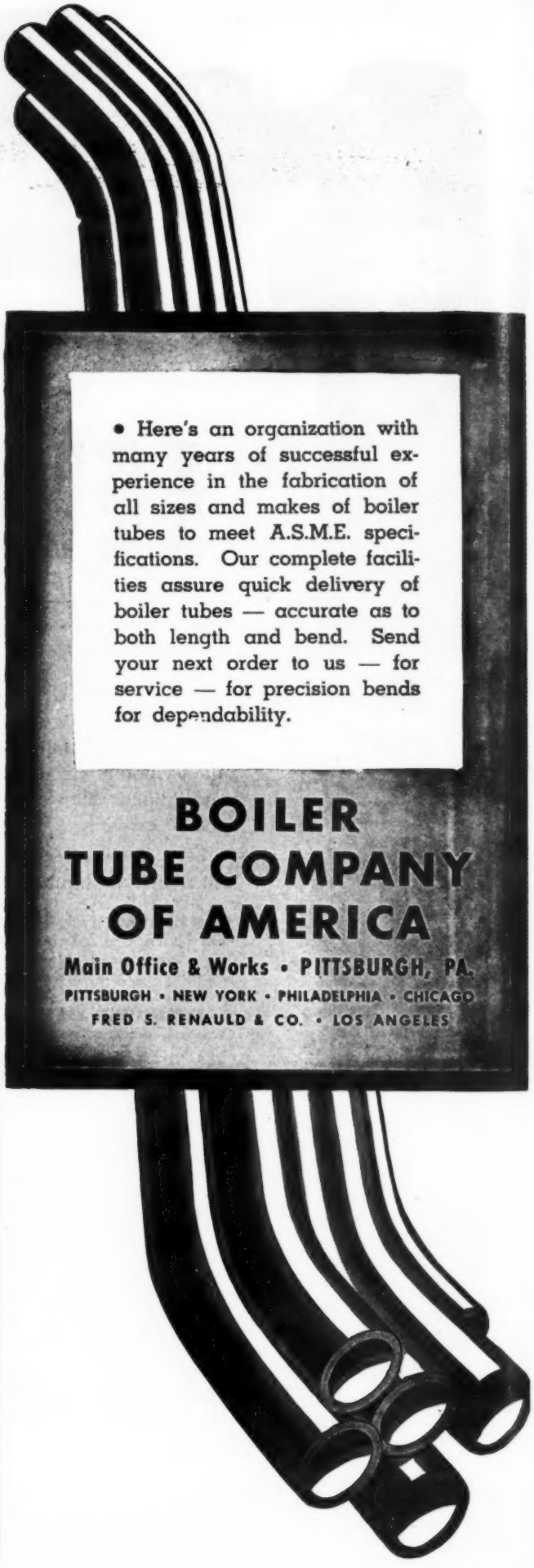

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QUIZ NO. 135

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IN COOPERATION WITH
UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF MINES

Prepared by Special Committee Steam Trap Manufacturers

★

WASTE CHASERS QUIZ

★

SEPARATING STEAM TRAPS

1. WHY ARE STEAM TRAPS USED? Steam traps are used to remove condensate from steam lines, radiators and steam heated process units with minimum loss of steam. If there were no steam traps, large quantities of steam would enter the condensate return lines, resulting in great waste of fuel.

2. WHAT KIND OF STEAM TRAPS ARE THERE? There are two main types of steam traps. One, separating traps, which accept condensate at one pressure and discharge it to a lower pressure; the other, pumping steam traps which take condensate at low pressure and discharge it against a higher pressure. The discussion in this Quiz Sheet will be limited to separating traps and wherever the term STEAM TRAP is used a separating trap will be meant.

3. IS THERE MORE THAN ONE KIND OF SEPARATING TRAP? Yes, there are six different types as follows:

a. *Thermostatic Traps*—in which the discharge valve is controlled by the temperature surrounding a bellows or diaphragm, or by the density of fluid passing through two orifices in series.

b. *Ball Float Traps*—in which the position of the discharge valve is directly controlled by a ball float which rises as condensate enters the trap and falls as condensate leaves the trap. One trap of this type uses a ball float to lift a weight which then falls and opens the discharge orifice.

c. *Float and Thermostatic Traps*—which use a ball float to control the water discharge and a thermostatic element to control the venting of air.

d. *Upright Bucket Traps*—Water spilling into the upright bucket opens the valve. The water is forced out of the bucket through a syphon tube which causes the bucket to float and close the valve.

e. *Inverted Bucket Traps*—in which the inverted bucket is completely submerged in water. When full of steam it floats and closes the discharge valve. When water displaces steam, the bucket sinks to open the valve.

f. *Thermodynamic Traps*—in which the temperature of the condensate regulates the rate of flow through the trap orifice.

g. *Tilting Traps*—Incoming water fills the tank to a point where the increased weight of the water overcomes the effect of the counter-balancing lever and weight, allowing the tank to tilt forward and automatically opening the discharge valve which allows the water to flow to its point of disposal.

4. WHERE SHOULD TRAPS BE PLACED? In general, traps should be installed below the units that they drain. Traps should be in an accessible location. Otherwise the maintenance man may neglect them entirely.

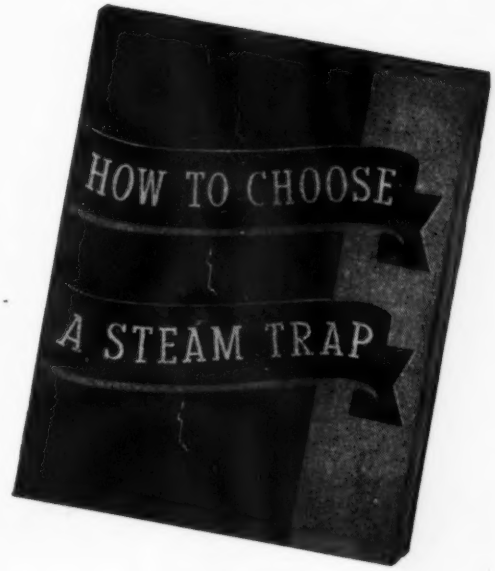
5. SHOULD TRAP BE INSTALLED ON EACH STEAM HEATED MACHINE or HEATING UNIT? In general, yes. The practice of draining two or more steam heated units with a single trap is more than likely to result in short circuiting. Air and/or condensate may accumulate in one or more of the machines. Such machines will be below steam temperature and will operate at less than maximum efficiency. These machines must be operated longer to turn out the same amount of work. Non-productive radiation losses are thereby increased, which, of course, means excess steam consumption, to say nothing of the extra labor cost of operating the machine.

6. ARE YOUR TRAPS PROPERLY SIZED? If too much time is required to bring kettles, tanks, heaters, coils, etc., up to temperature, it may be that the traps are too small and have insufficient air-handling capacity. Make certain that your traps have sufficient capacity for starting and for peak operating loads. Examine water gauges on separators and drip pockets to be sure that they indicate no accumulation of condensate.

7. ARE YOUR STEAM PRESSURES CORRECT? When the steam supply to heating and process units is controlled by a regulating valve, the steam pressure should be checked at regular intervals. If too high, the elements of thermostatically operated traps may not be able to open their valves against the higher pressure. If too low, heating and process units will not get enough steam and traps may not have enough pressure differential for satisfactory drainage.

8. DO PETCOCKS BLOW STEAM? Where pet cocks are used to prevent air binding make sure that an absolute minimum of steam is being wasted to the atmosphere.

9. DO GAGE COCKS OR GLASSES LEAK? Check carefully and replace if necessary.



The National Fuel Efficiency Program, in cooperation with the Bureau of Mines, has recently published the Fuel Waste Chasers quiz shown above. This quiz deals with the efficient use of Steam Traps to save fuel. It asks many pertinent questions about their use. The answers to these and many more questions concerning the efficient use of Steam Traps are found in the book, "How To Choose A Steam Trap", which is yours upon request.

Super-Silvertops can be piped as an elbow or straight-in-line.

In addition to helping to save steam for the War Program, you have another interest in this waste chasers quiz . . . When you save fuel costs by the efficient operation of Steam Traps you are increasing the efficiency of your steam using units. When considering the purchase of new Steam Traps, this book shows how to select a more economical trap that will save waste in the future. That trap is Super-Silvertop Steam Trap, the most economical means of draining condensate from steam using equipment. Write for your copy today.

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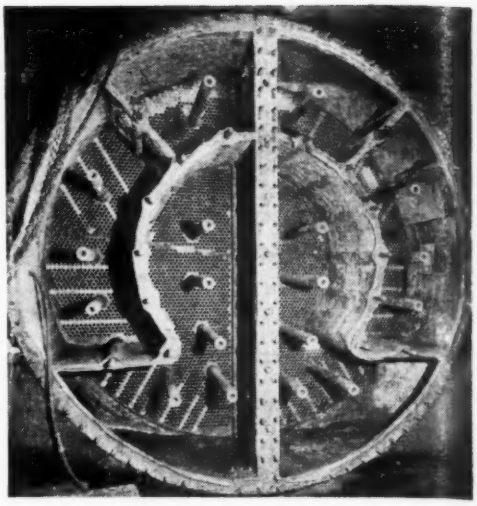

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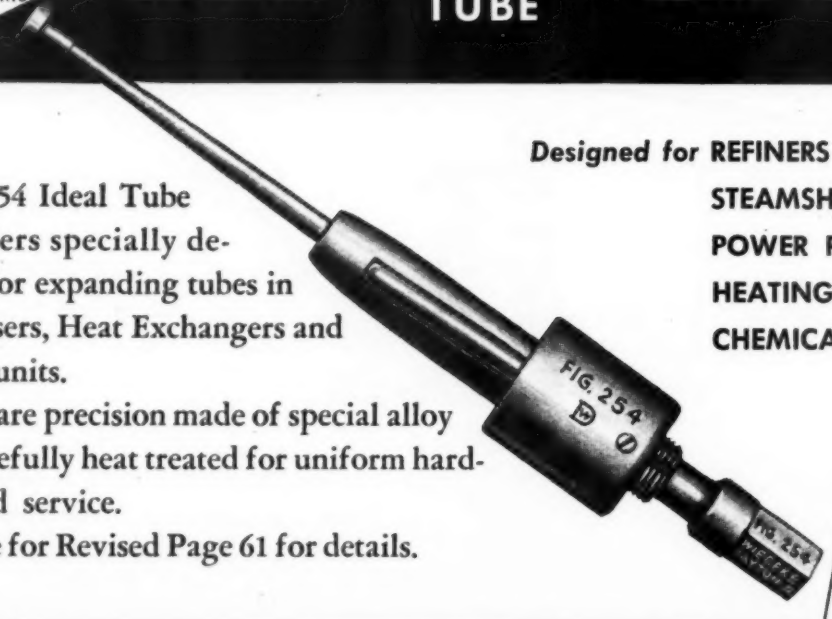

FIG. 254 Ideal Tube Expanders specially designed for expanding tubes in Condensers, Heat Exchangers and similar units.

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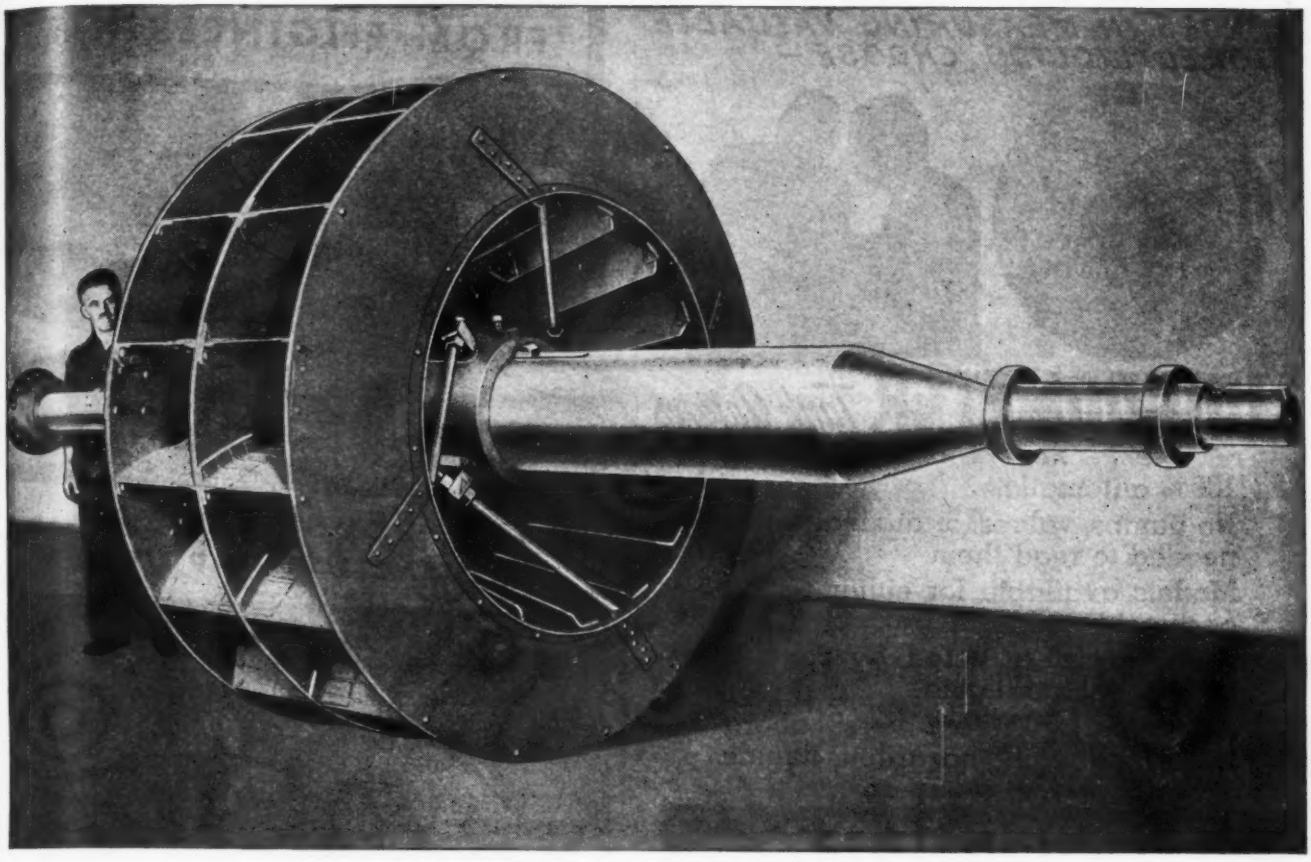


Do "Buffalo" Induced Draft Rotors Wear Well? Here is the Waukegan record

The main difficulty experienced with modern pulverized fuels has been wearing-out of induced draft fan rotors, due to erosion and corrosion. Many of these fans have required blade or rotor replacement every six to twelve months. Read below the performance record of Buffalo Induced Draft Fans at Waukegan.

Three Buffalo induced and three forced draft fans, called Unit No. 3 were bought by Waukegan generating company back in February, 1924. This unit has required 1 set of blades in 1938; 48 blades in 1944.

Unit No. 4, bought in January, 1929, had one set of new blades in 1938.

Unit No. 5, bought in November, 1929, has had no replacements to date.

It is not by accident that Buffalo Induced Draft fans stand-up under difficult conditions. The engineering "know-how" puts metal where it's needed, shapes blades to provide most efficient operation. Why not insist on this advanced engineering in your fans?

"Buffalo" "First For Fans"

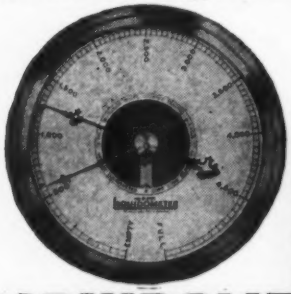
BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Induced Draft Fans

THOSE WHO CAN'T AFFORD TO MAKE ERRORS IN MEASURING VALUABLE STORED LIQUIDS CHOOSE—



LIQUIDOMETER *Tank Gauges*

"THEY'RE ALWAYS DEPENDABLE"

100% automatic.

No pumps, valves, or auxiliary units needed to read them.

Models available for either remote or direct readings.

Accuracy unaffected by specific gravity of tank liquid.

Approved by Underwriters' Laboratories for gauging hazardous liquids.

Write for complete details.

THE LIQUIDOMETER CORP
.3-65 LIMAN AVE., LONG ISLAND CITY, N.Y.

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WITHOUT HALTING TRAFFIC

No longer is it necessary to close off an area of concrete floor while waiting for newly installed patches to set. Flexrock offers a new plastic repair material which is ready for traffic almost the moment it's put down.

Tamp Smooth! Truck Over Immediately!

There is no waiting. Simply shovel INSTANT-USE into the hole or rut—tamp—and your floor is restored to solid smoothness . . . back in service without delay. Tough INSTANT-USE bonds tight to old concrete, makes long-lasting heavy duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

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Please send me complete INSTANT-USE information and details of FREE TRIAL OFFER—no obligation.

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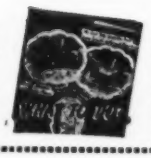


FROM ENGINEERING

THROUGH EVERY MANUFACTURING PROCESS

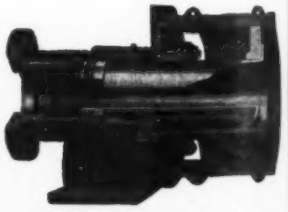
ADSCO EXPANSION JOINTS

Offer Exclusive Built-in Features

In ADSCO'S large, modern plant with foundry and expert welding equipment, skilled workmen make a wide range of ADSCO Expansion Joints to meet exact code standards. They build them with bronze, semi-steel or steel bodies — for controlling the expansion of low or high pressure steam, hot water, gasoline, oil, air or other pipe lines.

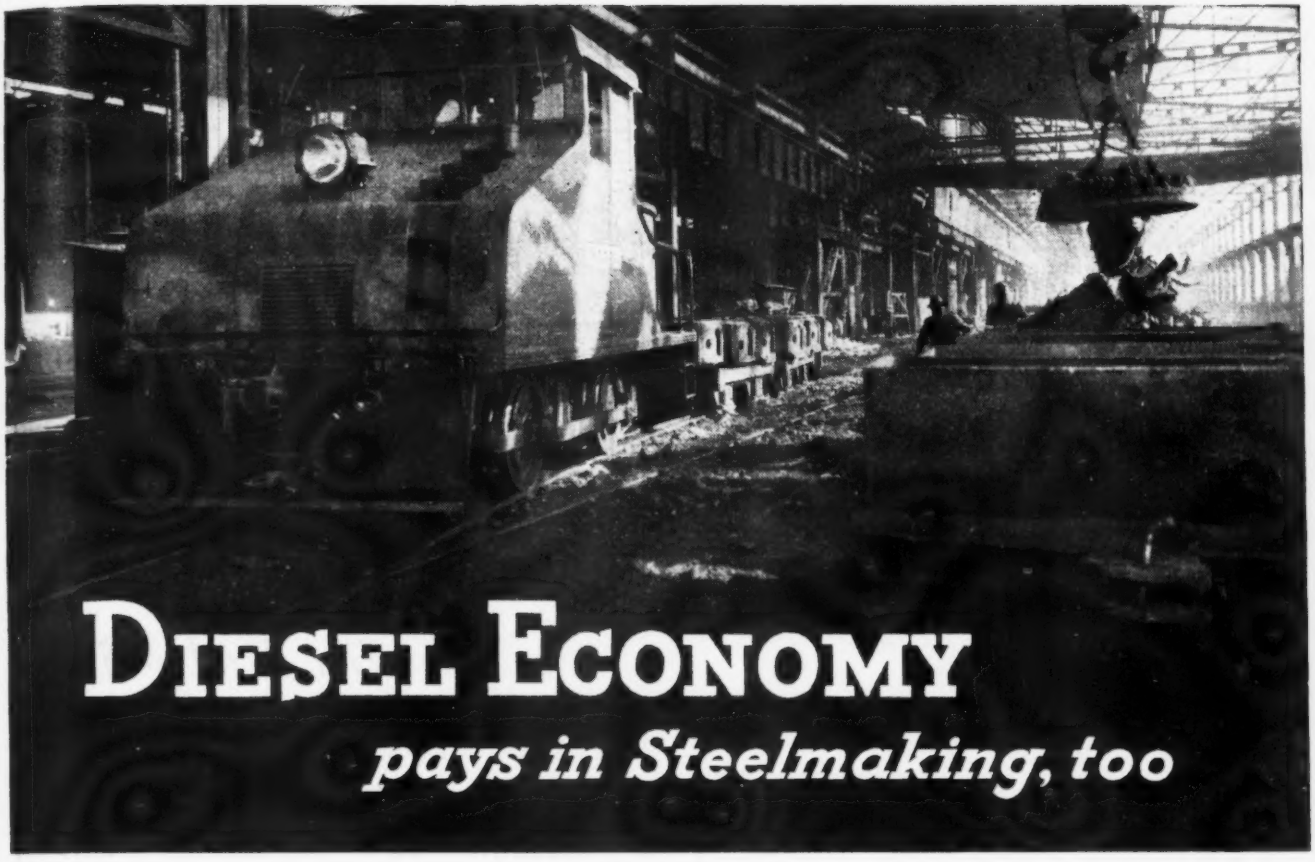
Exclusive features of ADSCO Joints include the internal guide ring to prevent the slip from pulling out of the body — the external, two-piece removable guide — the Piston-Ring joint which can be unpacked and repacked under full operating pressure without interruption to service — the Duplex-Sleeve Joint, etc.

All joints described in ADSCO Catalog No. 35PR.



ADSCO Piston-Ring Joint

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, NEW YORK
Makers of "UP-TO-DATE" Steam Line Equipment For Over 65 Years



DIESEL ECONOMY

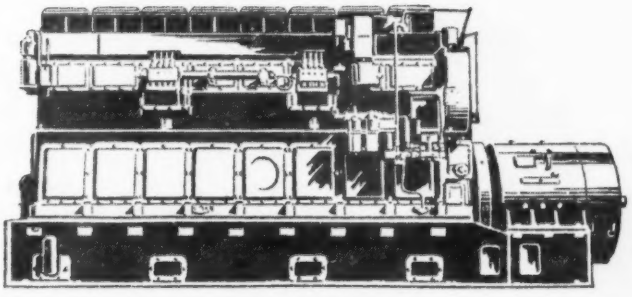
pays in Steelmaking, too

DOZENS of tough jobs in a steel plant are handled most satisfactorily and economically with diesel power — as this 65-ton Cooper-Bessemer powered locomotive could testify.

All down the line, from moving hot iron and scrap and stone to spotting railroad cars for loading out the finished products, diesel power is quick, efficient, low in cost.

Your C-B diesel-powered locomotive is always ready to go, quick to accelerate and decelerate, ready to put its full power into any job instantly. When you're not using the power, you're not wasting fuel.

Right now you, too, are thinking past Victory of America's reconversion problems. You'll be interested in replacing high-cost, obsolete and worn-out equipment with modern machines of the latest, most efficient types. When it comes to prime movers — locomotive as well as stationary engines to drive generators, blowers, pumps, compressors — you'll save your company time, trouble and money when you specify Cooper-Bessemer diesels.



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BUILDERS OF DEPENDABLE ENGINES FOR 111 YEARS

New Model A-1 *Pur-O-fier*

For Compressed Air

Positive purification of air lines is assured with this new Model A-1 Pur-O-fier designed to eliminate free moisture, oil and foreign matter in small compressed air systems. It operates with from 1 to 5 cubic feet of air and for intermittent operations is extremely sensitive to the slightest movement of air. Weighing only 1¼ lbs., this new unit is just 3⅛" in diameter by 5⁹⁄₁₆" deep including plastic, transparent entrainment sump. Model A-1 Pur-O-fier requires no maintenance.

Drain valve permits easy and quick draining of the sump. Pur-O-fier uses positive, centrifugal action as a medium for purification and can be used for air-operated instrument controls, air-operated gauges of the precision and checking type, and air-operated cleaning devices of many types. This unit will operate effectively from 1 to 75 P.S.I. Write for bulletin No. 11 giving complete details.

Patent applied for

Write for New Bulletin No. 11 giving complete specifications and applications

BIRD-WHITE COMPANY
3120 WEST LAKE STREET
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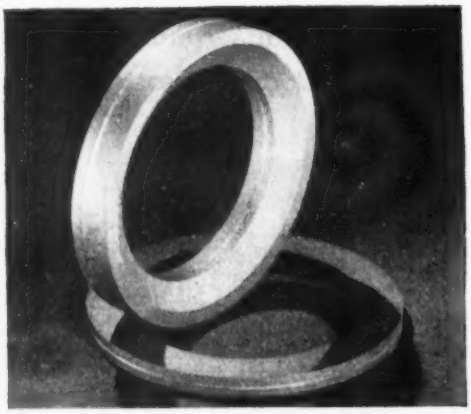
HOPPES
FEEDWATER HEATERS
Deaerating and Non-Deaerating

Write for Bulletin

THE HOPPES MFG. CO.
Established 1881
SPRINGFIELD OHIO

SAVE TIME . . . CUT MAINTENANCE COSTS with VELVETOUCH *ALL-METAL* STEAM SEALS



Velvetouch Steam Seals are a modern development in powder metallurgy . . . scientifically designed and engineered to meet exacting industrial requirements.

Velvetouch all-metal Steam Seals are meeting with unqualified approval on a wide range of machines using either rotary or stationary steam joints.

Only Velvetouch offers all six of the following exclusive advantages—

- **Withstands steam pressures up to 400 PSI.**
- **Will not freeze or rust under prolonged shutdown.**
- **Low coefficient of friction eliminates brake load.**
- **Never becomes an abrasive.**
- **Lubricated by steam.**
- **Wears longer than ordinary type steam seals.**
- **Available for many standard joints.**

For further information on Velvetouch Steam Seals and their applications, write directly to:

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Pioneers in Putting Powder Metallurgy to Work for Industry

Save MAINTENANCE TIME

with
WALWORTH
FIG. 709
Saddle Gate
VALVE

Bronze
STEM
STEM NUT
STUFFING NUT
GLAND
BONNET BUSHING
WEDGE
SEAT RING

THE *Iron Valve* WITH *Bronze* WHERE IT'S NEEDED

If you want to reduce valve maintenance time on lines where frequent cleaning and inspection are required — specify Walworth Fig. 709, the bronze-mounted Iron Body Saddle Style Wedge Gate Valve.

Easy to take apart because of its U-bolt body-to-bonnet connection, this valve permits quick inspection, easier cleaning, and rapid re-assembly, and can be re-packed under pressure in either the open or closed position. It is recommended for general use on steam, gas, gasoline, water, oil, and process lines, and is especially suited for lines carrying sludge, fluids of high viscosity, or mixtures which might have a tendency to clog under the disc or between the valve seats.

Walworth Fig. 709 is made with bronze wedge, seat rings, stuffing nut, gland, bonnet bushing, stem and stem nut. The bonnet and body are made of cast iron. Two drain holes located inside the bonnet permit the line fluid to drain off when the valve is open, thus eliminating the danger of serious damage due to freezing. This valve is furnished with either screwed or flanged ends, in sizes from ¼" to 4".

All Iron Valve

For services where line fluids are corrosive to bronze trim, Walworth offers Fig. 711, an iron body valve which has malleable iron wedge disc and stuffing nut, and steel gland and rising stem. This valve is available in sizes from ¼" to 4" (Screwed), and 1" to 4" (Flanged).

For further information on these Walworth Valves — and details on Walworth's complete line of valves and fittings — write on your company letterhead for a free copy of Catalog 42.

ARMY NAVY E

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WALWORTH

valves AND fittings

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WALWORTH ★ VALVES AND FITTINGS ★ ESTABLISHED 1842

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The Simplest of All Pump Designs Assures Longer Trouble-free Service

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Sturdy and compact, Ropers require less space and permit periodic inspection of internal parts without disturbing piping or power units.

You can rely on a Roper for the most productive, economical service any pump can render.

Competent engineering and consultation service is at your disposal.

Send for Bulletin 244

A summary and digest of factual information concerning pumps and pumping problems.

GEO. D. ROPER CORPORATION
ROCKFORD, ILLINOIS

ALSO BUILDERS OF AMERICA'S FINEST GAS RANGE

How to get the most out of AIR COMPRESSORS

shown in the complete practical guide to efficient and economical

Selection
Installation
Operation
Maintenance

Here is a priceless new manual for every design, plant, or operating engineer concerned with machines and processes involving air compressors. In great detail and the clearest kind of language, and with over 400 explanatory illustrations, it tells everything you need to know about all types of compressors, in order to choose the right kind for a specific installation and to put it in service, keep it in service, and get the most out of it.

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By EUGENE W. F. FELLER
Operating Engineer, formerly Assistant Chief Operator, Safe Harbor Water Power Corp., Associate Editor, *Power*

460 pages, 5⅛ x 8¼, 414 illustrations, $4.50

Here's a brief idea of what this helpful book gives you:

—information on the kinds of compressors available, with the pointers on performance, service limitations, etc., needed in selection

—complete mechanical description of every part of reciprocating, two impeller, sliding vane, liquid piston, centrifugal, and axial compressors

—full explanation of load-control devices, compressor lubrication requirements, and other special topics

—instructions and diagrams on location, foundation, erection, alignment, adjustment, and other details of compressor installation

—directions for operating all types of compressors, with special attention on trouble points to watch

—maintenance helps, covering everything from minor adjustments to the making and fitting of piston rings

Procedure for lining up rotating shafts—convenient separate chapter of air compressing theory—material on hydraulic air compressing—comparative costs and pointers on compressor selection—these are other helpful features of this exceptionally thorough and practical manual.

Includes a complete description of the **GAS TURBINE** of which the axial compressor is a necessary accessory, giving you an up-to-the-minute view of the features of this formidable newcomer in the field of power generation.

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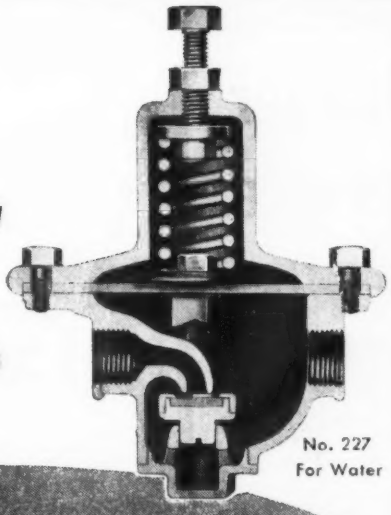
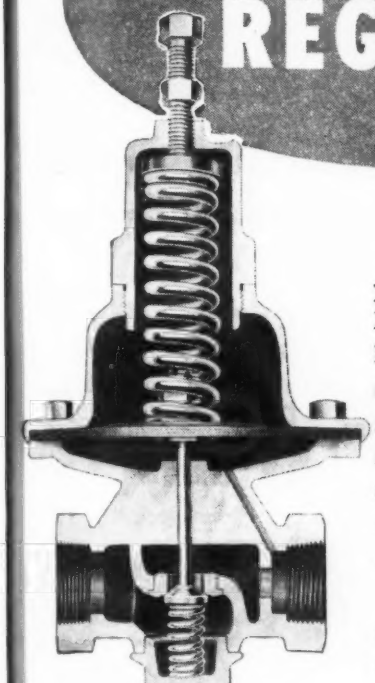
A DIRECT APPROACH TO YOUR PRESSURE REDUCING PROBLEMS



No. 227
For Water

MASONEILAN REGULATORS

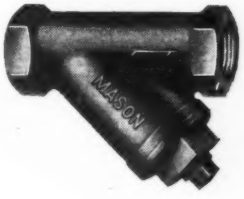


No. 11 For Steam

The simplest and surest way to head off your pressure reducing headaches is to install Masoneilan Regulators. These pressure regulators give you accurate control of air, water and steam pressures. They save you money by reducing waste, minimizing time out of service and cutting maintenance to practically zero. Their rugged heavy-duty construction means accurate, long operating life under all operating conditions.

Get accurate, dependable pressure reducing service . . . use Masoneilan Regulators. The distributors listed at the right will gladly take care of your needs. Catalog 73 is available on request.

Use a Masoneilan Strainer in all water, steam or air lines to protect valves, traps, etc., from scale, dirt or other foreign matter. These strainers are precision-built for long reliable service. They cost no more than others. Sizes ¼" to 1½".



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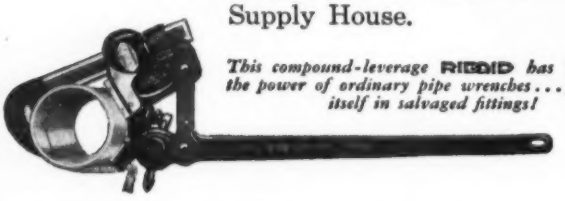
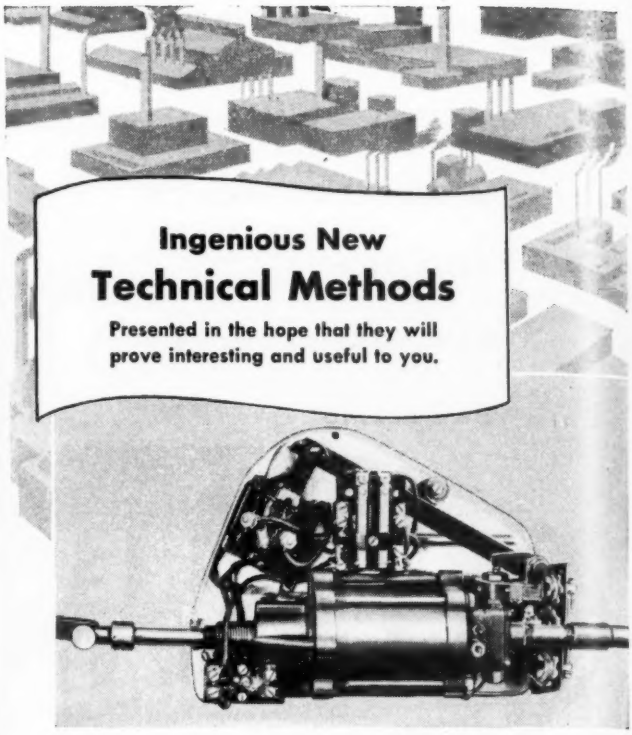


This compound-leverage RIDGID *has 14 times the power of ordinary pipe wrenches . . . pays for itself in salvaged fittings!*

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.



Ingenious New Technical Methods

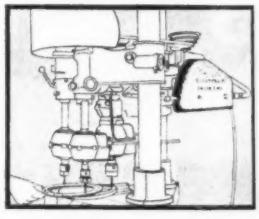
Presented in the hope that they will prove interesting and useful to you.

New Electroaire Power Unit Converts Standard Drill Press to Automatic

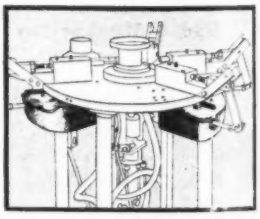
This exact control over feed and retraction speeds permits ready conversion of a standard drill press with tapping head into an automatic tapping machine, capable of producing Class III threads, even with comparatively unskilled operators. By adjusting speed to conform to the lead pitch of the threads being tapped, the tap will cut without forcing threads, and on the reverse the tap will actually "float" out of the part with no strain against the thread angle.

Air-powered jigs and fixtures can be opened, closed, and indexed by the Electroaire Power Feed. The unit can be set for a pre-determined number of cycles so that multiple holes can be drilled in the same piece without ejection, by means of an indexing fixture controlled and synchronized by the Electroaire Unit. One operator can run as many as two or three drill presses, turning out top-quality work with few rejects and with a minimum of tool breakage, thus effecting a great savings in time.

Present stockpiles of finest quality materials used in the manufacture of Wrigley's Spearmint chewing gum are now exhausted—necessitating discontinuance of production. When a supply of proven materials—known to be up to the finest standards of quality—is again available, Wrigley's will resume production—And Wrigley's Spearmint will be back to again help you on your job. In the meantime they are manufacturing a war brand. Wholesome but not excellent enough for the Wrigley brand name.



Set up to punch 3 holes simultaneously

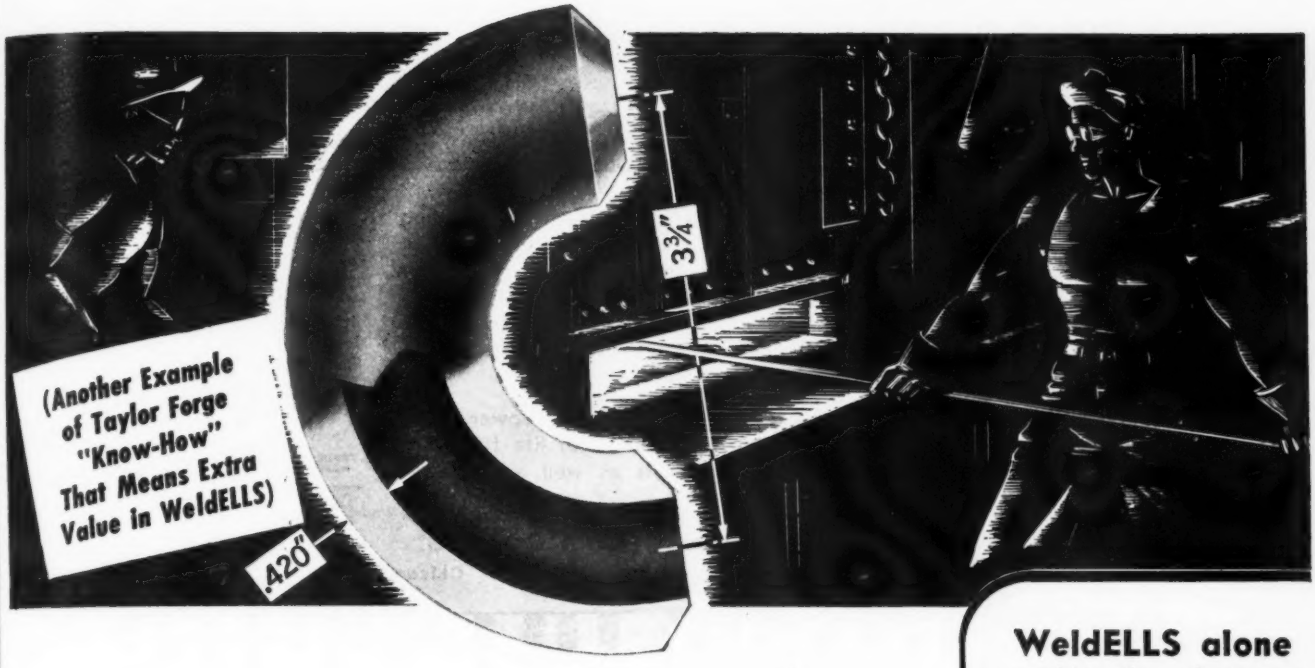


Shows holes being drilled automatically

You can get complete information from Electroline Manufacturing Company, 1975 East 61st Street, Cleveland 3, Ohio.

Z-56

WHO ELSE COULD MAKE THIS?



●As far as we know, no one else ever forged a fitting like the one pictured above—or any welding elbow or return bend having a wall thickness so heavy in proportion to the size of the fitting.

Such fittings simply can't be made by the processes ordinarily employed in the manufacture of welding fittings. But a special method, developed and patented by Taylor Forge, makes them "duck soup" for us . . . . An excellent example, this, of the problems that are so often put up to us by engineers who feel we are a little better qualified to solve them than any other organization.

●It isn't likely that you will ever run into a condition calling for a fitting of this kind. We simply cite such problems to show you—far better than we can tell you—how much specialized knowledge has gone into our *standard* line of WeldELLS and other Taylor Forge welding fittings.

Do not underestimate the importance of this broad experience. In WeldELLS the "know-how" acquired in solving every conceivable kind of forging problem is reflected in features that are combined in no other make of welding fittings!

A good example of this is the selective reinforcement—extra metal properly distributed where stresses are greatest. Another is the tangents; another, the final truing operation which produces those extremely accurate dimensions. These, and the other features listed opposite, give you a better job of pipe welding at lower cost. Check over the list and we believe you will agree that

WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

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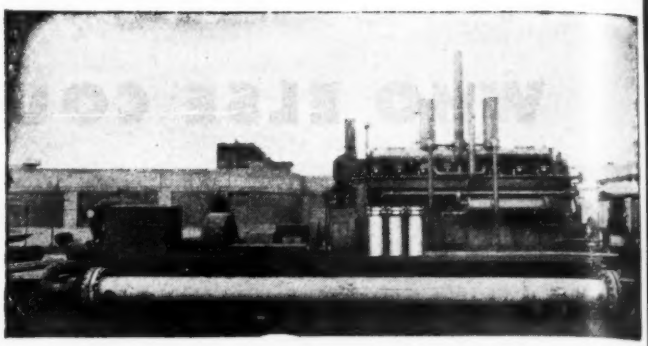
with

NUGENT FILTERS



HERE'S a filter that's a sure bet when it comes to providing positive protection for Diesel engines. The Nugent Absorbent Depth Type Pressure Filter shown at the left absorbs four times its own weight of water and impurities yet it does not remove any of the essential additives embodied in the oil. Available in a wide range of sizes for Diesel engines from 1 to several thousand H.P. in single containers.

Diesel operators who can't take a chance with power interruptions rely on Nugent Filters to add hours of life to Diesel engines . . . reduce maintenance costs as well as increase engine efficiency.

The photo above shows one Nugent Absorbent Type Fuel Oil Filter and two Nugent Lubricating Oil Filters installed on a Cooper-Bessemer Diesel engine which is connected to Worthington centrifugal pump. The installation is located at a well known pipe line station.

NUGENT TRADE MARK

WRITE TODAY for Latest Bulletin

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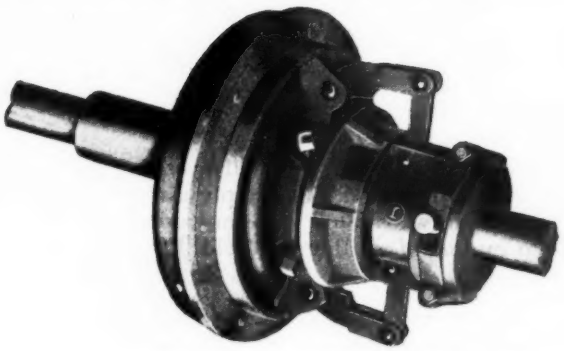
402 N. Hermitage Ave. Chicago 22, Ill.

SINCE 1897

NUGENT FILTERS

JONES-LEMLEY FRICTION CLUTCHES



JONES-LEMLEY friction clutches are built for a broad range of shaft sizes and ratings in both enclosed and open types for sleeve and coupling work. In addition they are available in a line of Jones-Lemley friction clutch pulleys. This clutch modification is also used for gears, V-belt sheaves, sprocket wheels, etc. Sizes, ratings, dimensions, prices and other data are contained in Bulletin No. 60. Your request will bring a copy.

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PILLOW BLOCKS • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

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2. **Coal Bunker Linings**—LUMNITE concrete resists abrasion and corrosion.
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7. **Overnight Structural Concrete**—For rapid maintenance, LUMNITE provides full-strength concrete in 24 hours or less, even in freezing weather.

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Send for the names of dealers near you and for detailed information on specific uses of LUMNITE in power plants. Also ask for reprint of article **"Deterioration and Maintenance of Power Plant Structures."**

THE ATLAS LUMNITE CEMENT COMPANY

(United States Steel Corporation Subsidiary)

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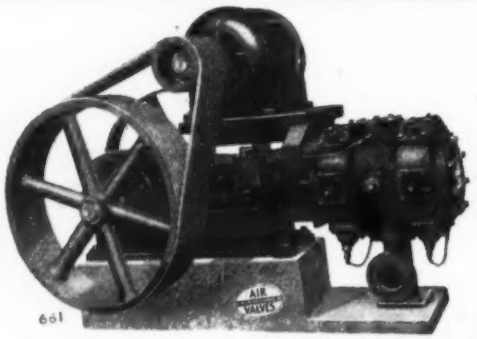

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The Everlasting Valve opens with an easy 70-degree movement of the operating wrench; provides unimpeded straight-through flow; closes with the same ease and sureness. Each opening or closing action re-grinds the disc, keeping it tight-fitting.

The sealing valve

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Write for Everlasting Bulletin E-100 giving full information.

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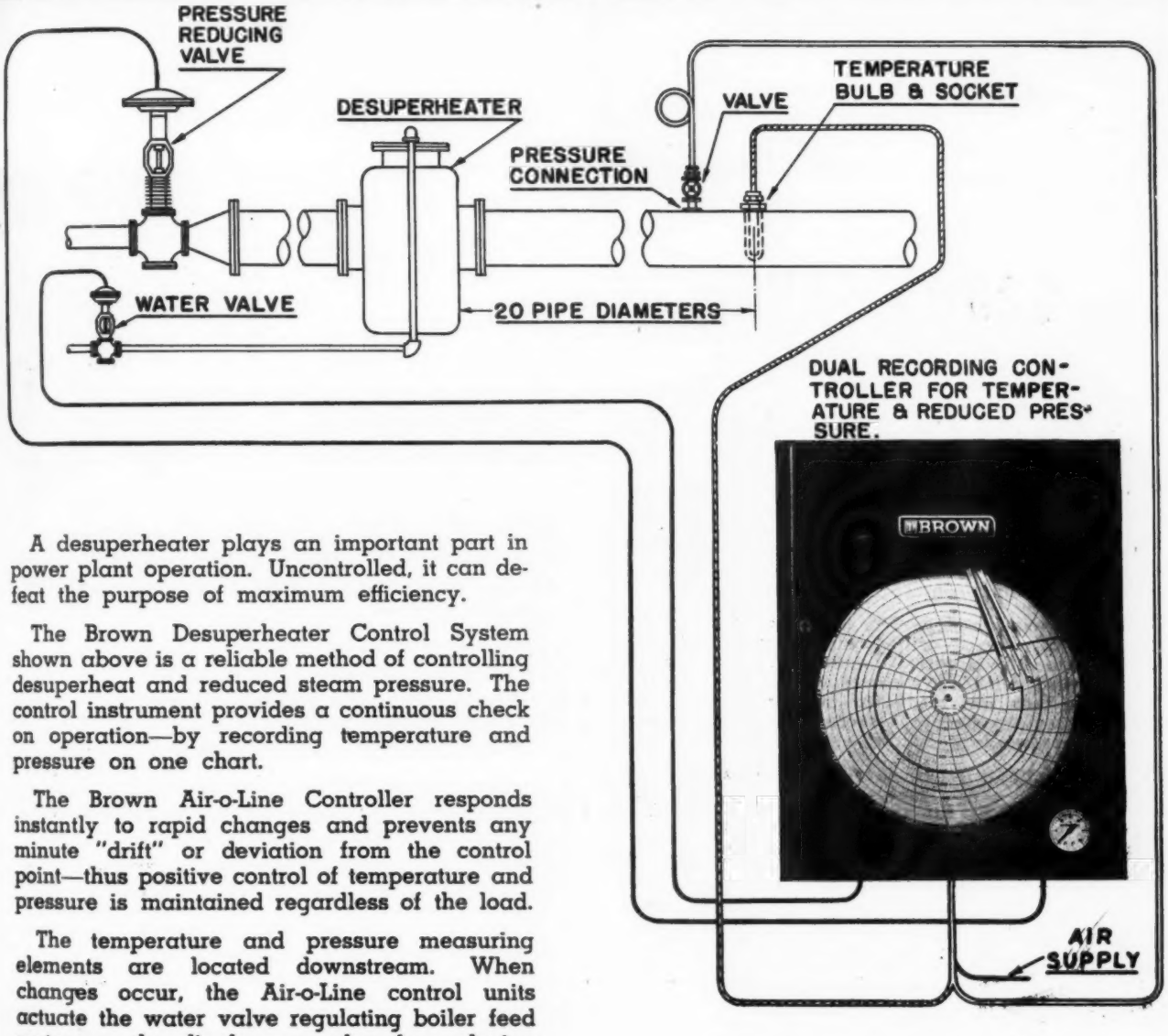
SOLVES *the* DESUPERHEATER *Control Problem*



A desuperheater plays an important part in power plant operation. Uncontrolled, it can defeat the purpose of maximum efficiency.

The Brown Desuperheater Control System shown above is a reliable method of controlling desuperheat and reduced steam pressure. The control instrument provides a continuous check on operation—by recording temperature and pressure on one chart.

The Brown Air-o-Line Controller responds instantly to rapid changes and prevents any minute "drift" or deviation from the control point—thus positive control of temperature and pressure is maintained regardless of the load.

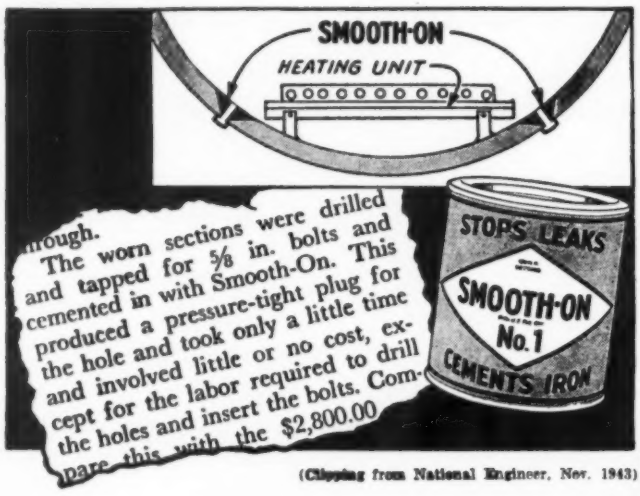
The temperature and pressure measuring elements are located downstream. When changes occur, the Air-o-Line control units actuate the water valve regulating boiler feed water—or the diaphragm valve for reducing steam pressure—to insure stable operation.

For centralized control—The Brown Newmatic Desuperheater Control System is available with remote transmission for recording and controlling temperature and pressures at any distance up to 1000 feet. Write for Bulletin 29-33.

Write THE BROWN INSTRUMENT COMPANY, *a division of the Minneapolis-Honeywell Regulator Co.*, 4490 Wayne Ave., Philadelphia 44, Pa. Offices in all principal cities: 117 Peter Street, Toronto, Canada; Wadsworth Road, Perivale, Middlesex, England; Nybrokajen 7, Stockholm, Sweden.

BROWN *Air-o-Line* THERMOMETER CONTROLLERS

OUTSTANDING PERFORMANCE WITH SIMPLICITY



...rough.
The worn sections were drilled and tapped for ⅝ in. bolts and cemented in with Smooth-On. This produced a pressure-tight plug for the hole and took only a little time and involved little or no cost, except for the labor required to drill the holes and insert the bolts. Compare this with the $2,800.00

(Clipping from National Engineer, Nov. 1943)

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by using a little

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This Smooth-On repair saved a heavy expenditure of $2800 for a new tank, and probably much inconvenience. Yet its cost was infinitesimal—just a little Smooth-On No. 1 and a small labor charge. No heat required, no serious dismantling.

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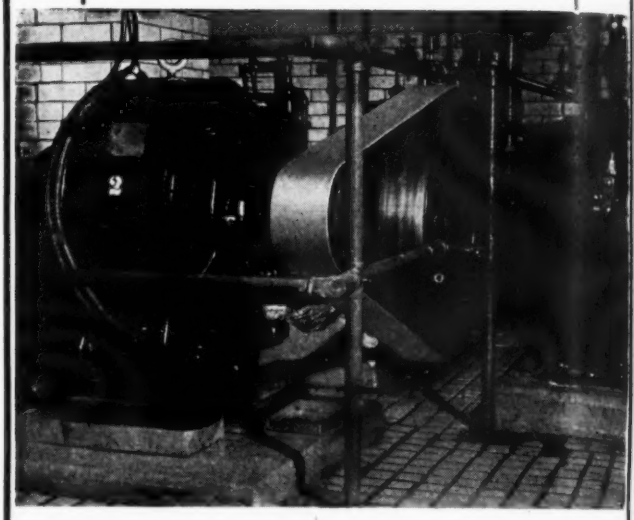

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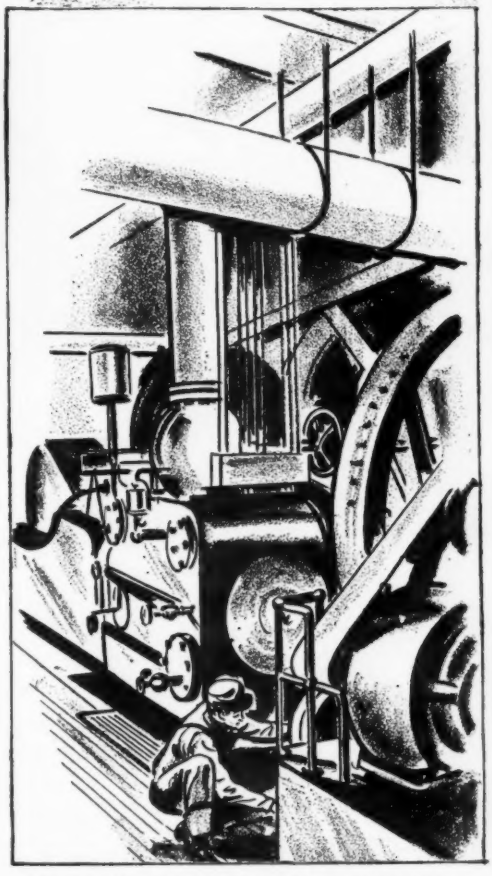

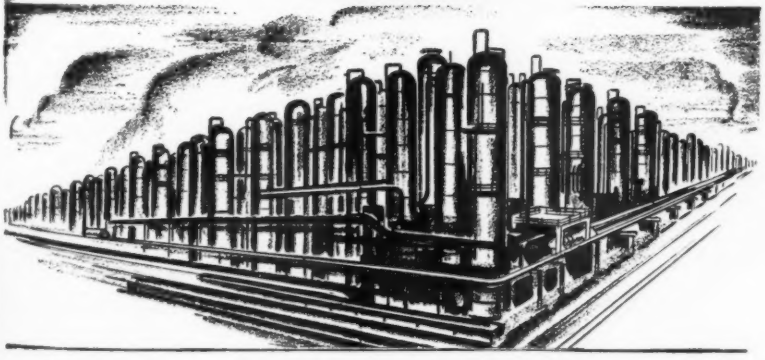

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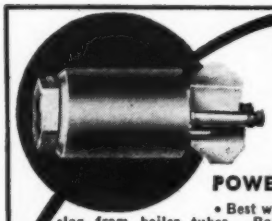

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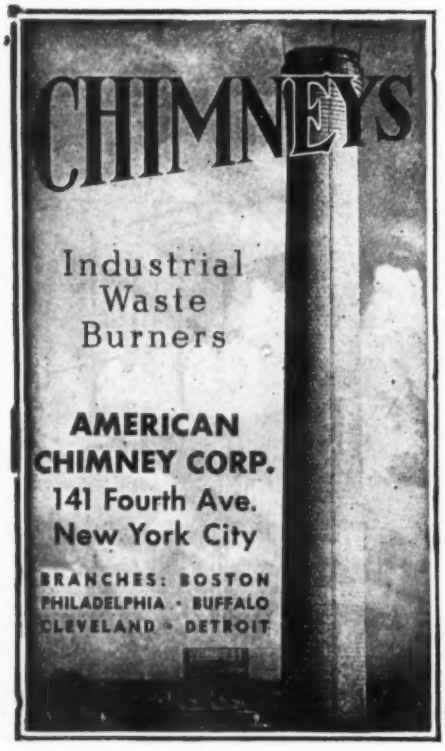

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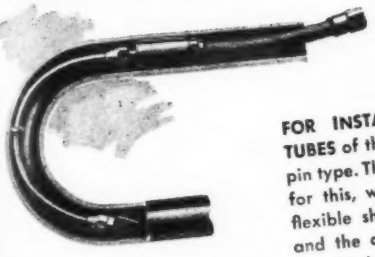
TRICKY TUBE CLEANING made easy-

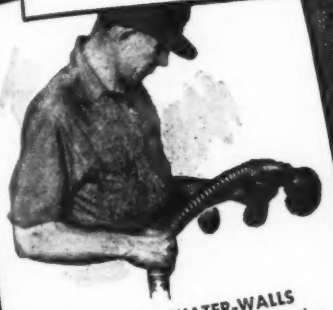
Here are just a few examples which serve to show the versatility of Elliott tube cleaners, and the alertness and ingenuity of Elliott engineers in devising methods that take the toughness out of tube cleaning.

Have you a ticklish or unusual job that calls for this kind of experience? Take it up with Tube Cleaning Headquarters.

ELLIOTT COMPANY
Tube Cleaner Dept., **SPRINGFIELD, OHIO**
DISTRICT OFFICES IN PRINCIPAL CITIES

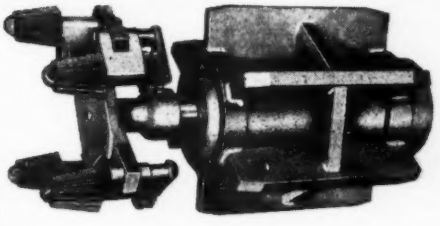


FOR INSTANCE, SUPERHEATER TUBES of the return bend or hair-pin type. There is an Elliott cleaner for this, with a length of strong flexible shaft between the motor and the cutter head, which may be a threaded cone or a single-pin head. The motor does not have to go round the bend, which is cleaned halfway around from each straight portion of the tube.



TO CLEAN WATER-WALLS Not really a tricky job, as the cleaning of side-, floor-, and water-wall tubes is common procedure using the agile and powerful Elliott 1300 Series motor with universal joint and proper Elliott cutter head. This equipment has flexibility to reach two tubes through one hand-hole opening.

BIFURCATED TUBES, TOO can be difficult — but not with this special equipment, which includes a guide to direct the cleaner into either tube. The guide threads into the tube, and can be turned and locked in the desired position. A flat on the end of the unit indicates the direction of the guide.



LARGE TUBE AND PIPES Not a usual job around a power plant, but sometimes necessary as in new installations, to remove sand, mill scale or weld sputter from fabricated pipe. The picture shows a 4¾ in. motor with special sleeve for entering 10 in. pipe. Cutter heads are available up to 20 inches.

ONE-MAN CLEANER CONTROL In all tube cleaning, but on tricky jobs especially, it is easy to see how vitally helpful is the Elliott foot-throttle valve. This enables the man guiding the cleaner also to start it, speed it up, throttle it down, or stop it, all instantaneously. Works like the accelerator on an auto—and certainly accelerates any job of tube cleaning.

All the above developments, and many more, described in the new Elliott Book on Tube Cleaning —on request.

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FIG. 1

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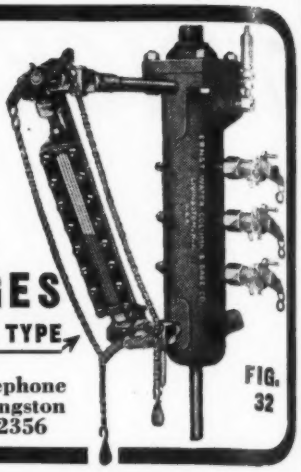

FIG. 32

ALLPAX

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2500 KVA Allis Chalmers condensing turbine generator unit, 2300 volts, 200# steam pressure, with jet condenser

1250 KVA Allis Chalmers condensing turbine generator unit, 2300 volts, 150-200# steam pressure, with jet condenser

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3 phase, 60 cycle

750 KVA General Electric generator, 2300/480/240 volts, direct connected to Skinner uniflow engine, 150# steam pressure, 0-5# back pressure

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Mercury Arc Rectifier

250 volts D. C.

300 KW Allis Chalmers mercury arc rectifier with 3 phase, 60 cycle, 4150 volt transformer, and rectifier control panel

(Additional Searchlight Ads on pages 362-380)

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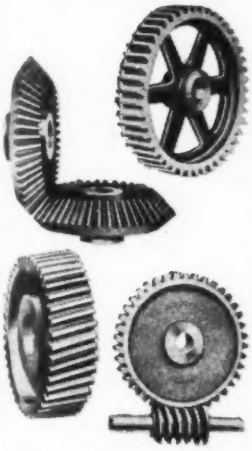

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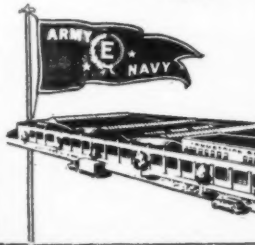

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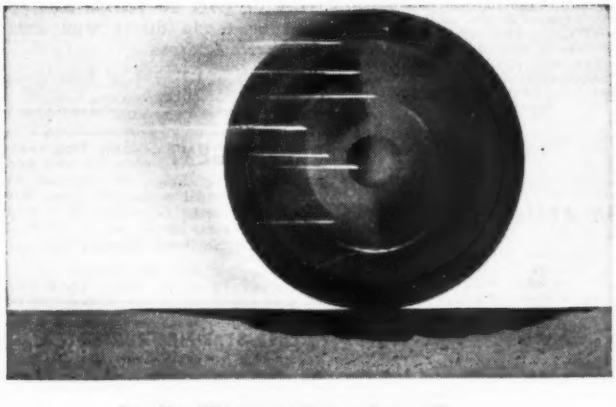

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QUICK-FLOOR is a plastic—sets by pressure—takes no drying time. Use just as it comes from the drum. No mixing—no preparation—merely clean and prime the break—then apply QUICK-FLOOR. It's all a matter of minutes—the floor is never out of service.

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Power Plant Operating Engineer

Experience must qualify him to take full charge of a 1500 kw turbine-generator plant located in Michigan. Give age, detailed list of experience, education, and salary wanted in first letter. References will not be contacted until after interview.

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A manufacturer of steam power plant equipment with 40 years' experience in this field and a nationwide sales organization is interested in adding several new products to his line. This company has a strong financial position and has adequate research facilities for testing new products and doing any further development that may be needed. Address all information to

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DRAFTSMAN: Familiar with sugar refining company layout. State age, experience, salary. P-793, Power, 330 W. 42nd St., New York 18, N. Y.

LAYOUT-ENGINEERS, designers, design draftsmen. Preferably with design experience on gas or diesel engines, air compressors, etc. For actual drawing board work on layout and development of design on long range research project for U. S. Navy. The Baldwin Locomotive Works, Eddystone, Pa. Statement of availability from W.M.C. required.

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STEAM POWER Plant engineer with 20 years experience as operating and chief engineer of small and medium size power houses. Sober and dependable. Good references. PW-795, Power, 330 W. 42nd St., New York 18, N. Y.

DIRECTOR OF Engineering—Electrical—46, Chief Electrical Engineer for two of Nations major electrical War installations, Chief Engineer additional project. Electrical direction office and field of widely diversified installations on construction approximately 250 million valuation in 20 years. Commendable background of general engineering, of operations and extensive experience in railroad field. Western location preferred but not essential. PW-797, Power, 520 N. Michigan Ave., Chicago 11, Ill.

SALESMAN WANTED

SALES ENGINEER—for young man with technical background in ceramics, metallurgy, combustion engineering or furnace construction, eastern manufacturer will provide training necessary to prepare him for the handling, through contacts with research and manufacturing departments, of customer problems related to selection and use of his products. Occasional field trips, to study applications first hand or supervise installations, are involved. Additions to sales force, as required, are made from manufacturers own seasoned sales engineering personnel to whom this type of work is attractive. Include age, present draft and release status. SW-794, Power, 330 W. 42nd St., New York 18, N. Y.

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Offers to represent good line of power plant equipment on exclusive agency basis.

Has thorough experience with steam and power generating equipment and accessories. Good sales record and contacts in Metropolitan New York area.

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Experienced stripping contractor having, due to exhaustion of present mine, organization and equipment available, desires to produce strip coal and deliver on railroad cars or truck to plant storage pile for utility company or large industrial consumer, thereby insuring it low-cost dependable fuel supply. Will enter into long-term contract and furnish highest references.

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EQUIPMENT WANTED ADVERTISEMENTS SEE PAGE 380

HI-LIGHTS OF *Hemphill* VALUES!

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The value of the equipment we offer you is prejudged by Hemphill experts—i.e. we buy or acquire control. We don't expect YOU to put money into equipment that we won't invest in first.

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MOTORS—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—400 HP, 1200 RPM, 220 volt, Westinghouse squirrel cage.
1—350 HP, 300 RPM, 440 volt, General Electric slip ring.
1—200 HP, 600 RPM, 2200 volt, G. E., sl. rg.
1—150 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
1—150 HP, 1750 RPM, Westinghouse, sl. rg.
2—150 HP, 1200 RPM, 2200 volt, Westinghouse, squirrel cage.
1—150 HP, 400 RPM, 440 volt, General Electric, squirrel cage.
1—125 KVA, 900 RPM, 220 volt, Westinghouse, synchronous.
1—125 HP, 720 RPM, Allis Chalmers, sl. rg.
1—100 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. rg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—80 HP, RPM, 550 volt, Cr. Whir. sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 720 RPM, 440 volt, Westghse., slip ring.
1—60 HP, 1200 RPM, 220 volt, General Electric, slip ring.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—150 HP, 500 RPM, General Electric, type MPC.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.

MOTORS—D.C. 230 VOLTS (Con't)

8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—30 HP, 750 RPM, G.E., Type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
1—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, G.E.
1—12/18 HP, 350/1200 RPM, Electro Dynamic.
3—11½ HP, 500/1500 RPM, Westinghouse.
1—10 HP, 400/1600 RPM, Westinghouse.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

MOTOR GENERATOR SETS

1—750 KW, 250 volt, Allis Chalmers, synchronous.
1—75 KW, 125 volt, General Electric, squirrel cage.
1—20 KW, 600 volt, General Electric, squirrel cage induction motor.
2—15 KW, 250 volt, General Electric, squirrel cage.
1—6½ KW, 125 volt, General Electric, squirrel cage.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—30 KW, 135 volt, Allis-Chalmers non-condenser.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 2300 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chal.

TRANSFORMERS

2—490 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh 7800/440 volts.
3—150 KVA, G.E., 33000/2300/4000 Y.
2—100 KVA, General Electric 2200/220/440 volt.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, Westinghouse, 13200-250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110 volts.
3—75 KVA, G.E., 13,500-750/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
2—50 KVA, Pbgh. 7500/15000 volts-110/220 volts.
2—15 KVA, G.E., 2300-115/230 volts.
2—100 KVA, G.E., 2400/240/480.

GASOLINE DRIVEN DC GENERATOR SETS

2—25 KW, 125 volt.
1—30 KW, 125 volt.

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TRANSFORMERS

1—200 KVA GE, type H.K. 2300/115/230 volts, 1 PH. 60 cy.
2—200 KVA GE, type H Form VD 4800/2400/480 volts, 1 PH. 25 cy.
1—100 KVA GE, type H Form KDD 11000/2600 volt. 1 PH. 60 cy.
2—75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
3—75 KVA Gen. Elect. K.S. 1 ph. 60 cy. 2300/115/230 volts.

OTHER SIZES VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

250 K.W.—(312 KVA) Gen.-Elect., Type A.T.I.—2300/4600 volt, 60 cycle 150 R.P.M. P. F. .08 with belted exciter.
240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle, 3 phase, 450 R.P.M. with direct connected exciter.
200 K.W. Westh. Unity Power Factor, 3 PH, 60 cyc. 220/440 900 R.P.M. with direct connected exciter.
150 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. Revolving field with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 with Rev. Field, and built in Exc.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.

FREQUENCY CHANGERS

30 K.V.A. Gen. Elect. type I.T.T. frame 526 P.F. 08—220/440 volts 3 Ph. 60 cy. to 240 volts 120 cycle Motor KT frame 526—3 Ph. 60 cy. 220/440 volts 1800 RPM.

ALL SIZES VOLTAGES AND CYCLES

3 ph. 25 cy. Motors

H.P.	Make		Type	Speed	Volts
350	Gen. Elec.	Sl. Rg. 3 Brg	I	375	400
200	Lincoln	S. R.	L. X. W.	500	440
150	Gen. Elec.	Sl. Rg.	I Form M	500	2200
100	Wagner	Sl Rg.	BR	750	220/440
150	Wagner	Sq. C.		500	220/440

3 ph. 60 cy. A. C. Motors

H.P.	Make		Type	Speed	Volts
200	West.	Syn.-Dir. Con. Ex.	P. F. 08	900	220/440
200	Gen. Elec.	Syn.	ATI	514	4000/2300
200	Weghse.	Syn.	Dir. Con. Exc.	600	2300
150	Burke	Sq. Cg.	3 Bg. 2 Ph.	900	220/440
125	Gen. Elec.	Sq. Cg.	I. K. Vert.	720	220

230 Volt D. C. Motors

H.P.	Make	Type	Speed
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
60	Sprague	D — Comp. Wound	625
40	Fair. Morse	Ball BRG. Vert. Comp.	1740

125 Volt D. C. Motors

H.P.	Make	Type	Speed
60	Allis Chalmers	FB131-Comp.	1755

550 Volt D. C. Motors

H.P.	Make	Type	Speed
35	West.	SK150 Shunt Int.	850

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V. 600 R.P.M.
50 KW Gen. Elec. DLC—Comp. Ind. 125 V.—1150 R.P.M.
50 KW—Northern—Comp. 110 V.—700 R.P.M.

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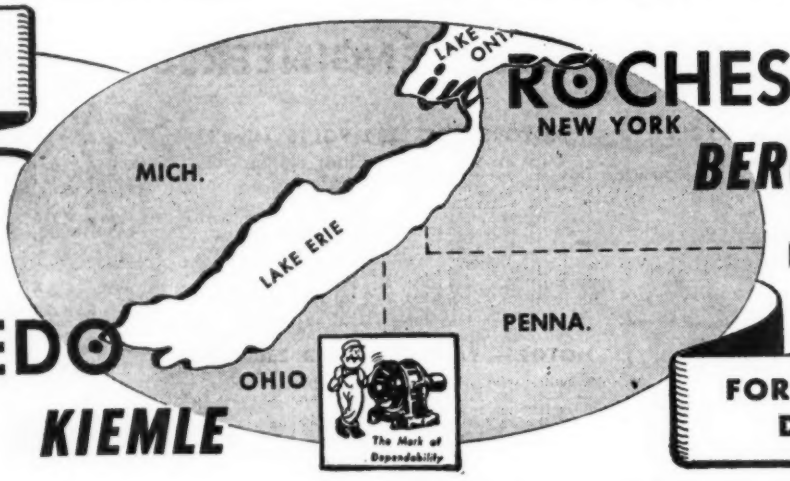

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3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300 1 phase 25 cycle.
1—350 KVA, GE, type H-K.D.D. 2300/460—1 PH, 60 Cy.
1—200 KVA Maloney type H.E. 2400/120/240 volts, 1 phase 60 cycle.
3—75 KVA Pitts. 1 Ph. 60 cy. 2300/230/115 volts.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

10 K.W. Gen. Elect. 1 Ph. 60 Cy. 220 Volts—1800 R.P.M.

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

WEST. D.C.—VARIABLE SPEED MOTORS

10—10 H.P. Type S.K. 220 V. 500/1500 R.P.M. with Automatic Dynamic Braking Starters and Field Rheos.

3 ph. 60 cy. A. C. Motors

H.P.	Make		Type	Speed	Volts
200	Weghse.	Sl. Rg.	CW	600	220/440
150	Gen. Elec.	Sq. Cg.	I.K.	600	2300
100	Gen. Elec.	S C.	K.T.	720	440
100	Gen. Elec.	S. C.	KT583	1150	440
100	Lincoln		M	1150	440
100	Gen. Elec.	R	MT	600	440

3 ph. 25 cy. Motors

H.P.	Make		Type	Speed	Volts
150	Gen. Elec.	S. R.	IM	500	440
100	Allis Ch.	S. R.		750	440
75	Gen. Elec.	Var.	BTA	375/750	440
75	Gen. Elec.	S. R.	I. M. 17B	160	440
75	Gen. Elec.	Sl. Rg.	I. M.	750	220/440

230 Volt D. C. Motors

H.P.	Make	Type	Speed
150	West.	SK 180L Comp. Wd. Int.	1150
100	Northwestern	K30 Comp. Inter.	1750
50	Crocker Wheeler	CM	625

MOTOR GENERATOR SETS

Gen.-Elect—100 KW. 2 brg. 125 volts D.C. Comp WD-Int. with 220/400 volts, Sq. Cg. Motor.

Rebuilt and Sold with a Standard New Guarantee

Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

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In the Belyea shops you will see experts working on small motors as well as giant generators and other items of electrical equipment of all sizes . . . rebuilding them, testing them, to standards of appearance and performance that match those of the original manufacturer. We have had 36 long years of such experience; and Belyea customers in all branches of industry KNOW they can rely implicitly on our GUARANTEE of successful performance of Belyea RE-NU-BILT equipment. The smallest as well as the largest job that comes into our shops receives the same care, is covered by the same guarantee—it will do your work efficiently, economically, profitably.

MOTOR GENERATOR SETS

3 Phase 60 Cycle

1—1500 KW G.E., 260/275 V. D.C. to 2100 H.P., 2300 V.
1—1000 KW G.E., 260/275 V. D.C. to 1400 H.P., 2300/4150 V.
1—500 KVA—330 KW—220/440 V. A.C. Gen. to 500 H.P.—230 V. D.C. Motor
1—500 KW G.E., 600 V. D.C. to 700 H.P. 132000/6600 V.
1—500 KW G.E., 250/275 V. D.C. to 750 Kva 440/2200 V. with exciter.
1—500 KW G.E., 275 V. D.C. to 1000 KVA 2300 V. Syn. Motor with exciter.
1—400 KW G.E., 260/275 V. D.C. to 650 H.P. 2300 V.
1—300 KW G.E., 600 V. D.C. to 435 KVA, 2300 V.
1—250 KW G.E., 275 V. D.C. to 435 KVA, 2300 V.
1—200 KW Whse., 250 V. D.C. to 300 H.P., 2300 V. Syn.
1—200 KW G.E., 125 V. D.C. to 400 KVA, 2300 V. Syn. Motor with exciter.
1—105 KW G.E., 70 V. D.C. to 180 H.P., 2300 V. Syn.
1—100 KW G.E., 250/275 V. D.C. to 150 H.P. 2300 V. Syn.
1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.
1—50 KW G.E., CD, 125 V. D.C. to 75 H.P., sq. cg., 2200/4000 V.
1—35 KW Whse., 125 V. D.C. to 53 H.P. 440/2200 V., Sq. Cg. Motor.
1—25 KW G.E., 250 V. D.C. to 40 H.P., 220/440 V. Ind. Motor.

3 Phase 25 Cycle

1—25 KW G.E., 125 V. D.C. to 35 H.P., 360 V. Motor.
1—75 KW Whse., 125 V. D.C. to 110 H.P., 440 V. Motor.
1—250 KW G.E., 250 V. D.C. to 285 KVA, 6600 V. Motor.

TURBO GENERATOR SETS

1—800 KW Whse. 625 KVA, 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 146/175 lb. cond. turbine complete with jet cond. and access.
1—75 KW Ridgeway 260 V. D.C. with Terry turbine 180 lbs. pressure with 12 lb. bk. pres., 3000 RPM.

FREQUENCY CHANGER

1—75 KW G.E., with 94 Kva .8 pf 240 volt type ATR, 3 ph. 60½ cycle gen. and 125 HP 440 volt 25 cycle ind. motor.
1—1000 KW G.E. with 1250 Kva .8 p.f. AQE 2640 volt 3 phase (can be changed—800 KW 3 phase) 83.3 cycle gen. and 1600 HP .8 p.f. 440/2200 volt ATT 3 phase 25 cycle motor and exciter.

A.C. MOTORS

3 Phase 60 Cycle

SLIP RING

Qu.	HP	Make	Volts	RPM	Desc.
1	100	G.E.	440	720	IM
2	100	G.E.	2200	575	IM
1	100	G.E.	550	685	MTC-5552
1	100	G.E.	550	720	IM
1	100	G.E.	220	1750	IM
1	150	Whse.	2200	1200	CW
1	150	G.E.	2200	600	IM-16
1	200	Whse.	2200	514	CW
1	200	G.E.	440	600	IM
3	250	Whse.	440/2300	450	CW
1	250	G.E.	4000	257	MT-424Y
1	350	G.E.	4000/2200	253	MT-442Y
1	400	G.E.	2200	252	IP
1	400	G.E.	440/2200	600	IP
1	400	A.-C.	2300	505	ANY
1	450	Whse.	2200	875	CW
1	600	G.E.	550	220	MT
2	600	G.E.	440/2200	720	IP
1	800	A.-C.	440	885	ANY
1	1200	C. W.	2300	237	801Q

SQUIRREL CAGE

Qu.	HP	Make	Volts	RPM	Desc.
1	100	G E.	2300	450	IK Vert.
1	100	G.E.	2200	1800	IE-13
1	125	Whse.	550	1140	CS
1	150	Whse.	550	400	CS-594A
2	175/112	G.E.	440	900/720	IK
1	200	G.E.	2200	490	IK
1	200	G.E.	550	580	IK
1	200	G.E.	440	900	IK
1	300	G.E.	440	900	IK
1	300	G.E.	440	600	IK-17B
1	300	Whse.	550	580	CS

SYNCHRONOUS

Qu.	HP	Make	Volts	RPM	Desc.
1	125	Whse.	2200	1800	
1	150	Whse.	4000	1800	dir. con. exctr.
1	225 kva.	G.E.	240	600	ATI-PB
1	400	G.E.	2300	720	TS
1	600	Al. Ch.	2300	720	
2	2100	G.E.	2200/4400	514	ATI

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Volts	Speed	Desc.
1	750	G E.	220/440	900	ATI
1	900	G.E.	2200/4600	1200	TS
1	1000	G.E.	2300/4100	900	ATI
1	3000	Al Ch.	2300	900	
1	5000	Whse.	2300/4000	900	

ROTARY CONVERTERS

3 Phase 60 Cycle

Qu.	KW	Make	Speed	DC V.	Trans. V
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	Whse.	720	250	22000
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300
2	375	G.E.	1200	250	6600/2300
2	300	G.E.	1200	600	2300

3 Phase, 25 Cycle Booster Type

2	1500	G.E.	500/325/275/13200/6600
1	500	G.E.	750/225/275/13200/6600

All units can be furnished with AC and DC controls

D.C. MOTORS

Qu.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	600	180
1	1200	Whse.	Int.	600	600/720
1	1200	G.E.	MPC	600	450
1	800	G.E.	MPC	650	600
2	625	G.E.	MPC	500	130
1	500	Whse.	Int.	250	250/720
1	500	G.E.	MPC	230	900
1	350	G.E.	MPC	230	450
1	300	G.E.	MPC	230	275/850
1	250	Al. Ch.		230	525
1	250	G.E.	C	230	375
2	200	Whse.	SK	230	600
1	175	Whse.	SK	230	150/525
1	150	G.E.	MPC	230	250/450
2	125	Cr. Wh.	CMC-45H	550	1200
2	125	G.E.	CQ-1525	230	625
1	100/150	Whse.	SK-200	550	600
1	100	G.E.	LC-50	230	1200
1	100	Whse.	SK-150	230	600
1	100	G.E.	RC-35	230	600
1	75/100	Whse.	SK-125	230	450/900
1	50/100	G.E.	MPC	230	225/450
2	75	Whse.	SK-125	230	500/1000
1	75	G.E.	C	230	500/1000
1	60	El. Dy.	248	230	525/1050
1	60	Diehl	K-11	230	500/1000
1	60	Al. Ch.	K-131	110	1750
1	50/60	Cr. Wh.	CMC-45H	230	500/1000
1	50	G.E.	RC-19	230	400/1200
1	50	Cr. Wh.	CMC-35H	230	330/750
1	15/50	Cr. Wh.	CMC-51H	230	300/900

SUCCESSFUL OPERATION GUARANTEED
Quality without Question

BELYEA CO., INC.
Main Office and Shop
43 HOWELL ST., JERSEY CITY, N.J.

RE-NU-BILT BELYEA MOTORS

L. J. LAND AND COMPANY

DEPENDABLE
ELECTRIC EQUIPMENT

MOTOR GENERATOR SETS

300 KW West. 250/125 v. d. c. 3 wire type SK 1150 RPM Factory built on C. I. sub-base. Direct Coupled to 3 ph. 60 cy motor with A. C. and D. C. Control.

250 KW G. E. Type MPC 125 v. d. c. 2000 amp. Factory built on C. I. sub-base direct coupled to 3 ph 60 cy motor with A. C. and D. C. Control.

40 KW Reliance 230 v. separate excited with 3 ph 60 cy 220/440 v. A. C. Motor.
10 KW Reliance separate excited vertical variable voltage 230 v. direct current, with 3 ph. 60 cy. 220/440 v. A. C. Motor.

DIRECT CURRENT
(Partial List Only)

230 VOLT DC MOTORS

H.P.	Make	Speed
60	El. Dynam.	900
60	G.E.	480/1100
50	West.	550/1100
50	G.E.	850
45	Diehl	850/1020
40	Cr. Wh.	915
35	West.	1150
25	Diehl	850/1020
25	G.E.	1150
25	G.E.	575
20	R & M	1160
20	G.E.	1150
20	West.	1150
20	G.E.	800 (2)
15	West.	1250
15	G.E.	1150
15	Cr. Wh.	900/1800
15	West.	850
10	West.	850
10	G.E.	825
10	G.E.	700
10	Al. Ch.	600/1800
10	West.	600/1200
10	G.E.	400/1600
10	West.	400/1200
9	G.E.	450/1800
7½	Peerl's	1700
7½	West.	1450
7½	West.	1150 (2)
7½	G.E.	1150
7½	West.	975
7½	Al. Ch.	850
7½	El. Dy.	550/1650
7½	Watson	525/1150
7½	G.E.	400/1600
7½	West.	400/1600
7½	Al. Ch.	350/1050
7½	G.E.	300/1200
6	G.E.	400/1200
6	G.E.	450/1800 (2)
5	West.	850
5	G.E.	900 (2)
5	West.	1800
5	G.E.	1150 (2)
5	Cont.	600/1800
5	West.	850
5	Star	600/1200
5	El. Dy.	550/1650
5	G.E.	450/800
5	G.E.	600
5	G.E.	450/1350
5	West.	400/1200
5	El. Dy.	275/1100

236 additional 230 volt D. C. Motors in stock as small as 1/20 H.P.

BELTED AND MOTOR DRIVEN DC GENERATORS

100 KW West.	250 volts
75 KW West.	250 volts
40 KW G.E.	250 volts
40 KW Reliance	250 volts
50 KW G.E.	250 volts
50 KW West.	125 volts
30 KW El. Dy.	600 volts
40 KW Cr. Wh.	125 volts
30 KW West.	125 volts
25 KW West	125 volts
25 KW G.E.	250 volts
20 KW G.E.	125 volts
15 KW West.	125 volts

43 additional Motor Generator Sets, 30 volts, 60 volts, 125 volts, 250 volts, and 250 volts as small as ½ K.W.

ALTERNATING CURRENT
(Partial List Only)

2 & 3 PHASE SLIP RING

H.P.	Make	Speed
250	G.E.	600
150	El. Dy.	1750
112	G.E.	900
100	Ideal	900
100	F.M.	690
75	West.	1170
75	West.	900
75	West.	720
75	Al. Ch.	575
64	G.E.	585
60	West.	1135
60	West.	290
50	G.E.	870 (2)
50	West.	850
40	Wagner	1150
40	F.M.	870
40	West.	870
40	Linc.	690
30	G.E.	870
30	G.E.	690
15/35	West.	6/1200 (5)
25/55	G.E.	6/1200
20/50	West.	6/1200
25	Al. Ch.	870 (2)
25	West.	850
25	G.E.	870 (2)
25	G.E.	720
25	West.	575
20	G.E.	870
20	West.	575

116 additional Slip Ring Motors in stock down to ½ H.P.

3 PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
200	G.E.	600
150	G.E.	860
150	West.	715
100	G.E. (BTA)	375/750
75	El. Dy.	1750 (4)
60	El. Dy.	1750
50	G.E.	1750
75	West.	870
50	West.	1200
50	G.E.	900
40	El. Dy.	1750
40	El. Dy.	1150
40	G.E.	900
35	Wagner	850
30	U. S.	3450 Vert.
30	Al. Ch.	514
25	Wagner	1200
25	West.	1140
25	Diehl	865
25	G.E.	900
25	Wagner	720
20	G.E.	1750
20	G.E.	1200
20	Cr. Wh.	1200
20	Al. Ch.	900
20	Diehl	900
20	G.E.	120
20	West.	1720

29—15 H.P. 4 speed 600/900/1200/1800 RPM Constant H.P. Ball Bearing motors, West. and Louis Allis.

15	G.E.	1200
15	Wagner	720
15	G.E.	600
10	G.E.	720
10	G.E.	3450
10	West.	1150

325 additional three phase Motors down to H.P.

SINGLE PHASE MOTORS

H.P.	Make	Speed
20	Wagner	1160
20	Cont.	1165
7½	Cont.	3500

AC GENERATORS

125 KW Cr. Wh.	900
100 KVA West.	600
60 KW G.E.	1200
25 KVA West.	1200

New York City's Largest Stock Electrical Machines
ESTABLISHED 1910
SOLD WITH A ONE-YEAR GUARANTEE

146 Grand St. • CAnal 6-6976 • New York 13, N. Y.

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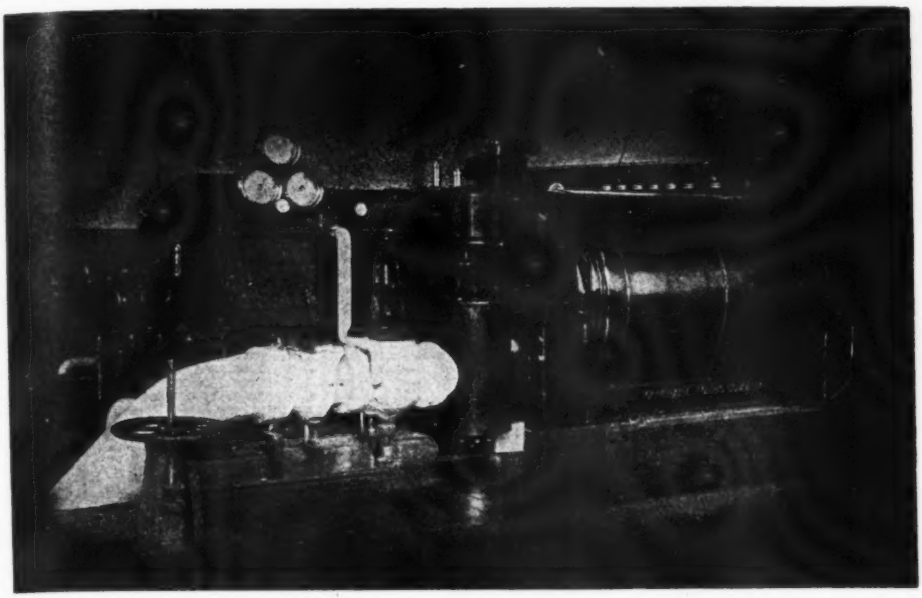
323 E. Market St.

EST. 1910

3125 KVA CONDENSING TURBINE-GENERATOR UNIT



ACTUAL PHOTOGRAPH

AVAILABLE IMMEDIATE DELIVERY

3125 KVA — 2500 KW 80% P.F. General Electric, 3 phase, 60 cycle, 2300 volt, 3600 RPM condensing turbine-generator unit, 180-200# I.S.P. 500° T.T., equipped with surface condenser, panels and instruments.

Excellent condition—a complete installation.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

1875 KVA G.E. condensing 175-200 lb. pressure, 500° T.T. 6600 volts, 3600 RPM complete with condenser.

937 KVA Allis-Chalmers condensing 175-200 lb. pressure, 100°, 4000 volts, 3600 RPM with direct connected shaft exciter, condenser and auxiliaries.

937 KVA General Electric condensing 150-175 lb. pressure, 2300 volts, 3600 RPM with direct connected shaft exciter, surface condenser and auxiliaries.

750 KVA Westinghouse non-condensing, 175-200 lb. pressure, 15 lb. back pressure, 480 volts, 3600 RPM, complete with switchboard.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

110 KVA Allis-Chalmers Kerr non-condensing, 125 lbs. pressure, 0-10 lbs. gauge back pressure, 240 volts, 3600 RPM with direct connected exciter.

ENGINE-GENERATOR UNITS

Direct Current

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to a 14" x 18" 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. back pressure, complete with switchboard.

350 KW G.E. 250 volt, 175 RPM generator direct connected to a 28" x 28" Skinner Universal Unaflow non-condensing engine.

125 KW, 125 volt, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lb. pressure, 10 lb. back pressure, complete with switchboard.

75 KW 125 volt, 1800 RPM Westinghouse non-condensing turbine-generator unit.

75 KW, 125 volt, 2400 RPM Allis Chalmers-Terry non-cond. turbine-gen. unit.

15 KW (3) Crocker-Wheeler, 125 volt, 410 RPM generators each direct connected to an American Blower vertical engine.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle Alternating Current

500 KVA (2) Westinghouse, 440 volts, 164 RPM generators each direct connected to Skinner Unaflow non-condensing engine, 135 to 150 lbs. steam pressure, 5 lb. back pressure.

375 KVA Westinghouse 240 volts, 225 RPM generator direct connected to 440 HP, 4 cylinders Nordberg vertical Diesel engine.

312 KVA Elliot 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

250 KVA Westinghouse, 2300 or 480 volts, 200 RPM generator direct connected Nordberg Unaflow engine.

200 KVA General Electric 240 volts, 200 RPM generator direct connected to Skinner Unaflow engine—complete.

MOTORS

—3 phase, 60 cycle

125 HP 80% P.F. Elec. Mchy. 440 volts, 400 RPM synchronous.

60 HP G.E. 220 volts, 900 RPM squirrel cage induction complete with starting compensator.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring

SYN. MOTORS

3 phase, 25 cycle

1700 HP G.E. 2300 volts, 300 RPM.

910 HP Westgh. 2300 volts, 300 RPM.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers, 600 or 275 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volt, 300 RPM synchronous motor.

150 KW Westinghouse, 250 volts, 1200 RPM generator direct connected to 220 HP 80% P.F., 3 phase, 60 cycle, 440 volt synchronous motor.

FREQUENCY CHANGER SETS

750 KVA Westinghouse, 3 ph., 60-cy., 2300 v. alternating current generator dir. con. to 910 HP. 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

1200 KVA General Electric, 3 ph., 60 cy., 2400 v. alternating current generator dir. con. to 1700 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

SPECIAL OFFERINGS

9375 KVA Westinghouse, 3 phase, 60 cycle, 2300 volt, 1200 RPM alternating current generator.

1250 KVA G.E. 3 phase, 60 cycle, 2300/550/440 volts, 300 RPM alternating current generator.

1690 C.F.M. 110 lb. air pressure Ingersoll-Rand steam driven air compressor 125 to 150 lbs. steam pressure.

1590 C.F.M. 100 lb. air pressure Hardie-Tynes steam driven air compressor 150 to 175 lbs. steam pressure.

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

350 GPM, 720' head, 5 stage Allis-Chalmers centrifugal pump direct connected to 125 HP, 3 phase, 60 cycle, 2200 volt, 1750 RPM motor.

22" x 48" Nordberg Corliss belted type engine, 150 to 175 lb. pressure, 100 RPM.

BOILERS

3—410 HP Wickes A.S.M.E. National Code horizontal cross drum box header type water tube boilers, 160 lbs. pressure, complete with stokers and automatic fuel conveyors.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

1—18750 KVA General Electric Cond.
2—15500 KVA Westinghouse Cond.
1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 5000 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 3125 KVA General Electric Extras.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extras.
1— 750 KVA General Electric Cond.
1— 625 KVA General Electric Cond.
1— 625 KVA General Electric Non-C.
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

D. C. TURBO UNITS

1—1500 KW General Electric 250 V.
2—1000 KW General Electric 250 V.
1— 125 KW General Electric 125 V.
1— 75 KW General Electric 125 V.
1— 50 KW Gen. Elec.-Terry 125 V.
1— 25 KW Westinghouse 125 V.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 210 KVA Skinner Uniflow
1— 150 KVA Skinner Unibow
1— 94 KVA Ridgway 4-valve
1— 93.8 KVA Skinner Uniflow

D. C. STEAM ENGINE UNITS

1—500 KW Ames Uniflow 250 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway Uniflow 250 V.
1—250 KW Ames Uniflow 250 V.
1—200 KW Skinner Uniflow 125 V.
1—150 KW Ridgway 4-valve 125/250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—625 HP Worthington, 240 V. gen.
1—610 HP Campbell, 2400 V. gen.
1—520 HP Busch Sulzer, 2400 V. gen.
1—375 HP Worthington, 240 V. gen.
1—300 HP Worthington, 2300 V. gen.
1—300 HP Meint. & Say., 480 V. gen.
1—283 HP Coop.-Bess., 230 V. gen.
1—175 HP Sterling (gas), 480 V. gen.
3—160 HP Coop.-Bess., 216 V. gen.
1—145 HP Saperior, 220 V. gen.
1—125 HP Winton, 240 V. gen.

SURFACE CONDENSERS

1—20,000 sq. ft. Worthington
1—12,000 sq. ft. Worthington
1— 5,000 sq. ft. Westinghouse
1— 4,100 sq. ft. Ross

WATER TUBE BOILERS

2—1875 HP B. & W. 285-lb., Stokers
4— 760 HP B. & W. 200-lb., Stokers
1— 750 HP Edge Moor 200-lb.
2— 612 HP Stirling 200-lb.
2— 560 HP Erie City 460-lb.
2— 512 HP Stirling 265-lb.
1— 336 HP B. & W. 200-lb.
2— 300 HP Heine 200-lb.
2— 300 HP B. & W. 160-lb.

A. C. GENERATORS

2—1500 KVA G. E. 25 cy. 2200 V. 750 RPM
2—1250 KVA G. E. 60 cy. 480 V. 750 RPM
1— 500 KVA G. E. 60 cy. 2300 V. 360 RPM
1— 360 KVA West. 60 cy. 240 V. 360 RPM
1— 94 KVA G. E. 60 cy. 2300 V. 600 RPM
3— 62.5 KVA G. E. 60 cy. 220 V. 1200 RPM
1— 48 KW Elec. Mcy. 60 Cy. 2400 V. 1200 RPM
3— 37.5 KVA G. E. 60 cy. 220 V. 1200 RPM
2— 25 KVA G. E. 60 cy. 220 V. 1200 RPM

SYNCHRONOUS MOTORS

2—1250 HP G. E. 25 cy. 2200 V. 750 RPM
2—1125 HP G. E. 60 cy. 480 V. 720 RPM
1— 200 HP Ideal 60 cy. 4000 V. 514 RPM
1— 175 HP West. 60 cy. 4000 V. 514 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

4—3500 HP G. E. slip ring 2300 V. 120 RPM
1—2500 HP G. E. slip ring 6600 V. 253 RPM
1—1500 HP G. E. slip ring 6600 V. 253 RPM
1—1000 HP G. E. sq. cage 2300 V. 500 RPM
1—1000 HP West. slip ring 2200 V. 300 RPM
1— 500 HP G. E. slip ring 440 V. 450 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
1— 300 HP West. slip ring 440 V. 1200 RPM
3— 250 HP West. slip ring 2300 V. 720 RPM
1— 100 HP G. E. sq. cage 2200 V. 900 RPM
1— 75 HP G. E. sq. cage 440 V. 514 RPM

MOTOR GEN. SETS—60 Cy.

1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 75 KW General Electric 125 V. DC

ROTARIES—60 Cy.

2—2500 KW General Electric 250 V.
2—2500 KW Westinghouse 250 V.
2—1700 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
2— 750 KW General Electric 600 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
1— 500 KW General Electric 600 V.

FREQUENCY CHANGERS

2—12500 KW G. E. 60/25 cy. 300 RPM
2— 5000 KVA West. 25/60 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 2500 KVA West. 25/60 cy. 300 RPM
1— 1875 KVA G. E. 25/60 cy. 300 RPM
2— 1250 KVA G. E. 25/62½ cy. 750 RPM
1— 1250 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 60/25 cy. 300 RPM

SYN. CONDENSERS—60 Cy.

1—5000 KVA West. 5000 V. 720 RPM
1—3000 KVA Al. Ch. 2200 V. 900 RPM
2—1250 KVA G. E. 480 V. 720 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

3— 4000 KVA West. 63.5/110-19/33 KV
4— 2500 KVA G. E. 63.5/110-19/33 KV
3— 2500 KVA Pitts. 66000-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts. 66000-33000 V.
3— 600 KVA West. 66000-2300 V.
3— 333 KVA G. E. 66000-480 V.
3— 1667 KVA G. E. 44000-2300/4000 Y V.
4— 1667 KVA Pitts. 33000-2400 V.
3— 200 KVA G. E. 33000-2300/4000 Y V.
3— 150 KVA G. E. 33000-2300 V.
3— 75 KVA G. E. 33000-13200/11000 V.
1—15000 KVA Al. Ch. 27880-4560 V. 3 ph.
2—10000 KVA West. 28400-4580 V. 3 ph.
1— 6000 KVA West. 28400-2300 V. 3 ph.
2— 1800 KVA G. E. 23000/11500-575 V.
3— 967 KVA Packard 23800-440 V.
4— 400 KVA Pitts. 22000/11000-2200 V.
3— 250 KVA G. E. 22000-11000 V.
1— 6000 KVA West. 13200-2300 V. 3 ph.
1— 3000 KVA Kuhlman 13800-480 V. 3 ph.
6— 1667 KVA Pitts. 13200-2300 V.
3— 1900 KVA G. E. 13200-2300 V.
3— 200 KVA G. E. 13200-480 V. Pyranol
7— 967 KVA Moloney 11000-2300 V.
3— 150 KVA Pitts. 11000-2400 V.
3— 100 KVA West. 11000-250/125 V.
3— 1250 KVA G. E. 6600-550 V.

VOLTAGE REGULATORS
50 Cycle Induction

6—95 KVA 400 A. 2400 V. Gen. Elec.
1—72 KVA 300 A. 2400 V. Gen. Elec.
2—48 KVA 200 A. 2300 V. West.
6—36 KVA 150 A. 2400 V. Gen. Elec.
6—24 KVA 100 A. 2400 V. Gen. Elec.

OIL CIRCUIT BREAKERS

1— 400 A. 73 KV G. E. FK036 Outdoor
1— 400 A. 73 KV G. E. FHK036 Outdoor
1— 400 A. 50 KV G. E. FK0138 Outdoor
6— 400 A. 37 KV G. E. FHK0136 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB76 Outdoor
1— 400 A. 25 KV G. E. FK0138 Outdoor
2— 400 A. 15 KV G. E. FHK0136 Outdoor
1—2000 A. 15 KV West. E6 Indoor
1—1500 A. 15 KV West. E6 Indoor
1—1500 A. 15 KV G. E. FK12 Indoor
6—1200 A. 4.5 KV Condit D-12 Indoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

TURBO-GENERATORS

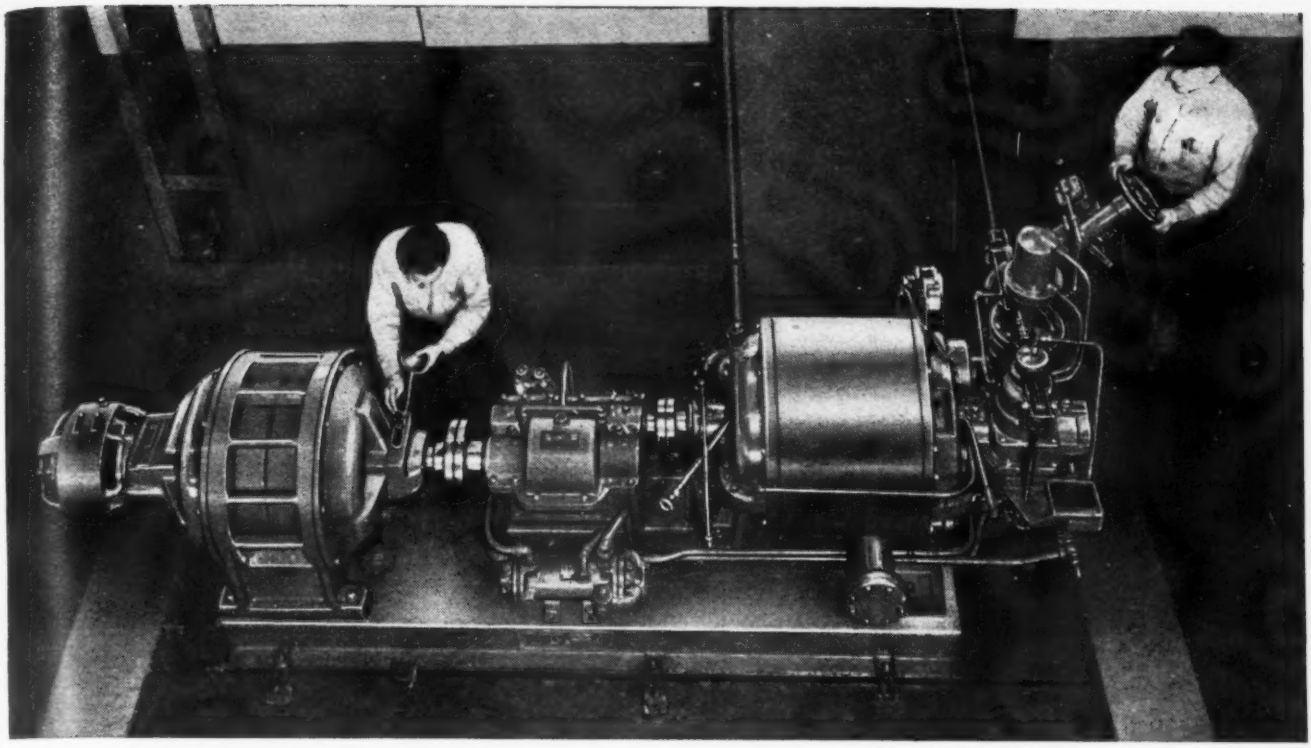
A FEW OF THE COMPLETE UNITS NOW IN OUR STOCK

1—6250—KVA. G.E. 3 60 2300V. 200#
1—3125—KVA GE 3 60 2300V. 200#
2—1875—KVA GE 3 60 2300V. 200#
1—1000—KW. DC, West. 250: 135 200#
1—1875—KVA. G.E. Non-Cond.
1—937—KVA GE Automatic Extraction 3 60 2300 V. 200 lbs.
2—937—KVA Allis-Chal. 3 60 2300:200#
1—250—KVA GE. Non-Cond. 3 60 480

Also Any Capacity or Type Desired.

WILMS, WEAVER & COMPANY

PENOBSCOT BLDG. DETROIT 26, MICHIGAN



4-F TURBO-GENERATORS MADE 1-A

YOU'RE looking at a 150 KW turbo-generator getting its final physical check-up on the O'BRIEN steam test block. It was completely dismantled, reconditioned and rebuilt in our own shops, and is being rigidly tested to meet exacting performance standards. It will be adjusted as required, the governor set and the entire job approved by an engineer. Only then will this generator merit the famous O'BRIEN guarantee.

This procedure was recently applied to a complete power plant supplied by O'BRIEN to a small town abroad. The plant consisted of a 500 KW turbo-generator with condensing equipment, exciters, switchboard, all pumps and piping, two 300 h.p. water tube boilers with heaters, pumps and piping. All equipment was thoroughly rebuilt and tested before shipment and at destination was set up under the supervision of O'BRIEN's engineer in the foreign country.

Whether you need one machine or a complete power plant, you'll find O'BRIEN the ideal time—and money-saving *single* source for new, used or guaranteed rebuilt equipment. No "desk broker", and few other shops, can equal O'BRIEN service and facilities. Inquire today for prices and deliveries on your specific needs.

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"Certified Rebuilt" ELECTRICAL APPARATUS

M-G SETS

100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125 v. coupled to 150 HP sq. cage I-K motor 3-60-2200/4000 V.

50 KW Northwestern rotary converter DC 230 V. input to AC 3 ph. 60 cycle 220 volts 1200 RPM with controls.

35 KW Gen. Elec. CD 115 gen. DC 48 v. 730 amp. coupled to 60 HP G.E. KT 536 motor 3-60-220/440 v. 1160 RPM, late style 3 brg. unit.

30 KW Gen. Elec. CD 103 gen. DC 60 v. 500 amp. coupled to 45 HP G.E. KT 532 motor 3-60-220/440 v. 1160 RPM, late style 3 brg. unit.

30 KW Hertner gen. DC 125 v. 240 amp. coupled to 47 HP motor 3-60-220/440 v. 1150 RPM, 4 brg. unit.

3—20 KVA Louis Allis Type ONA b.b. rotary converters DC 230 v. to AC 3 ph. 220 v. 60 cycle 1800 RPM.

Many others available—special units built to order

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
100	Gen. Elec.	DLC	230	575
100	Northw'n	interpole	230	1700
75	Whse.	S13L	230	450
50	National	CS	230	800
40	Gen. Elec.	DLC	230	750
40	Roth	S	115	850
30	Sprague	dynamom.	250	800/2000
25	Gen. Elec.	DLC	115	750
25	Gen. Elec.	LC	230	1700
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
20	Gen. Elec.	DLC	230	500/1500
20	Fair Morse	TR	230	325/1300
20	Whse.	SK	230	850
15	Gen. Elec.	CD75	230	1750
15	Gen. Elec.	CD83	230	1150
15	Whse. (6)	SK90	230	850
15	Gen. Elec.	CD95	115	575/172

QUICK SHIPMENT FROM STOCK

SEND FOR COMPLETE CATALOG #38A

SQUIRREL CAGE MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	150	Gen. Elec.	I-K	1200
1	150	Gen. Elec. 2200 v.	I-K	1800
1	125	Allis Ch. 2200 v.	AR	1800
1	100	Allis Ch.	AN	1800
1	100	Burke	EM	900
1	75	Whse.	CCL	720
1	75	Gen. Elec.	I-K	600
3	75	Allis Ch. 2200 v.	AR223	1800
1	75	Ideal	A	1200
2	60	Gen. Elec.	KT346	900
1	50	Allis Ch.	AN	1200
1	50	Gen. Elec.	KT542	900
4	50	Allis Ch.	AN	900
1	50	Allis Ch.	AN	720
1	40	Whse.	CX	600
1	40	Gen. Elec.	I-K	1200
2	40	Allis Ch.	AR420	900
1	40	Gen. Elec.	KT342	720
2	40	Gen. Elec.	KT532	1200
2	30	Gen. Elec.	KT326	1200
2	30	Gen. Elec.	KT332	900
2	30	Allis Ch.	AN	1200
1	30	Allis Ch. b.b.	AR220	900
2	30	Allis Ch.	AN	600
6	30	Allis Ch.	AN	900
1	30	Gen. Elec.	K505	600
2	30	Whse. b.b. New	CS405	1800
2	30	Allis Ch.	AN	720
4	25	Allis Ch.	AN	900
3	25	Gen. Elec.	I-K	1200
2	25	Gen. Elec.	KT522	1200
2	25	Allis Ch.	AN	600

25 CYCLE MOTORS

H.P.	Mfr.	Type	Speed
450	Whse. 2200 v.	CW sl.rg.	750
300	Whse.	CW sl.rg.	500
150	Whse.	HF sl.rg.	500
150	Gen. Elec. 2200 v.	MT359 sl.rg.	1500
100	Whse.	CCL sq. cg.	500
100	Gen. Elec.	I-K	750

SYNCHRONOUS MOTORS

H.P.	Mfr.	Type	Volts	Speed
300	Whse.	ped.	220/440	900
250	G.E. 1 brg.	ATI	220/440	600
50	Burke		220/440	1200

CENTRIFUGAL PUMPS

14" Foster Wheeler, 5000 gpm @ 45 ft.
10" Weinman, 2500 gpm @ 40 ft.
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.

SLIP RING MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	HP.	Mfr.	Type	Speed
1	500	Allis Ch. 2200 v.	ANY	514
1	400	G.E. 2200 v.	I-P	1200
1	350	Allis Ch.	ANY	514
1	300	Burke	EMV	225
1	200	Gen. Elec. 2200 v.	I-M	900
2	150	Triumph	SR	514
1	150	Gen. Elec.	I-M	720
1	100	G.E. 2200 v.	I-E13A	1800
1	100	Gen. Elec. 3 brg.	I-M	450
1	75	Gen. Elec.	MT356	900
1	75	G.E. 2200 v.	I-E13	1800
1	75	Gen. Elec.	MT558	600
1	75	Gen. Elec. 2200 v.	I-M	900
1	65	P & H b.b. int.	CA16	900
2	60	Whse. 2200 v.	CW657	1800
3	60	Gen. Elec.	M-505	1200
1	50	Gen. Elec.	MT536	1200
1	50	Al. Ch. b.b. 2200 v	ARY	900
1	50	Allis Ch.	ANY	720
1	50	Gen. Elec.	MT342	900
1	50	Gen. Elec.	I-M	600
1	40	Gen. Elec. 2 ph	MQ536	900
1	40	Northw'n	HW35A	1200
4	40	Gen. Elec.	MT532	1200
2	40	G.E. 2200 v.	MT332	1200

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
250	Northern		250	360
100	Gen. Elec.	DLC	250	700
50	Gen. Elec.	CL	125	875
30	Lincoln b.b. 600 amp.		50	1200
25	Gen. Elec.	CD103	125	1150
19	Gen. Elec. 300 amp.	CD	65	1200
16	Cr. Wheeler	CCD	125	415
15	Whse.	SK63	250	1750

ALSO IN STOCK . . . OIL SWITCHES . . . BLOWERS & FANS . . . SPEED REDUCERS . . . 500 NEW MOTORS

60 CYCLE A. C. GENERATOR

KVA	Mfr.	Type	Volts	Speed
500	Gen. Elec. 3 brg.	ATB	2300	450
300	Allis Ch.		240/480	600
300	Whse.	ped.	240/480	900
250	Gen. Elec.	ATB	240/480	600
200	Gen. Elec.	TRB	240/480	720
125	Whse.	ped.	2300	600
100	Cr. Wheeler		240/480	600
50	Gen. Elec.	ATB	240/480	1200
40	Burke		240/480	1200
30	Gen. Elec.	TAB	240	1800

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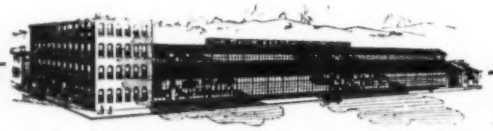

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1—937KVA Gen. Elec. with Wheeler condensor

1—500KW Allis Chalmers Moore non-cond.

1—500KW Gen. Elec. non-cond.

1—300KW Gen. Elec. cond.

ROTARY CONVERTERS

1—1500KW 250V Westgh complete

2—1000KW 250V Westgh complete

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, transformers, Circuit Breakers, etc. Please send us your inquiries.

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• SPECIALS •

1—1500 HP. General Electric 2200 volt 60 cycle, 3 phase, 720 rpm. slip ring motor with reduction gear.

1—1500 HP. Allis Chalmers 2200 volt, 60 cycle, 3 phase, 277 rpm. slip ring motor with reduction gear.

1000 KW. 250 v. steam engine generator set

500 KW. DC generator, 600 v. DC 900 speed, Allis Chalmers. Can assemble motor generator set

120 KW. 250/500 v. DC gasoline engine gen. set

100 KW. 125 volt, General Electric, 1200 rpm. motor generator set any AC voltage.

100 KW. 250 volt, Westinghouse, motor generator set synchronous drive. Any voltage.

70 KW Motor Generator Set, 70 v. 1000 Amp. Burke, synchronous drive.

667 KVA. transformers 23,000 volt primary 440 v. sec. 60 cy. single phase. Three units available.

35 KW. 125 volt motor generator set. Any AC voltage drive.

50 — New 3 HP. General Electric, 1800 rpm. 220 volt slip ring motors.

Phone us collect, station to station, on your requirements. Tell the telephone operator who is calling and the reason for the call.

ELECTRIC EQUIPMENT CO.

BOX 51 ROCHESTER, N. Y.

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1—440 HP Elec. Machinery, 3-60-440V, 900 RPM, two bearing syn. motor

1—400 HP Westinghouse, type CW, 3 ph. 60 cy. 440V, 450 RPM slip ring motor

1—300 HP General Electric, 3 phase, 60 cycle, 440 volt, 360 RPM, type MT 412 slip ring motor

1—1275 HP, Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1175 RPM slip ring motor

1—200 HP, Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1150 RPM slip ring motor

1—150 HP, General Electric, 3-60-400V frames 17A 360 RPM slip ring

1—150 HP Westinghouse, 2 ph, 60 cy, 440V frame 1000, CW, 390 RPM slip ring

1—100 HP General Electric, 3-60-440V, 495 RPM, MT 562 slip ring

2—100 HP General Electric, type I, form K, 3-60-220V 575 RPM

2—800 HP, 3 PH, 60 CY, 6600 V Westinghouse, type CW, slip ring 507 RPM mill type motors with liquid slip regulators.

1—150 HP DC Westinghouse type SK, frame 666.3, 600 V. 360/720 RPM ped. type mill motor, #4798360.

1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200 V, 1750 RPM, Squirrel Cage

1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 580 RPM slip ring

1—100 HP General Electric, 3 ph, 60 cy, 4000V, 720 RPM syn., type TS with direct connected exciter

2—100 HP Crocker Wheeler, size 2AQ, 3 ph, 60 cy, 440V, 385 RPM slip ring

1—100 HP Westinghouse, type CS, 3 ph, 60 cy, 440V, 1750 RPM sq. cage.

4—75 HP. G. E. 3-60-2300V, 400 RPM, type I, sq. cage

1—75 HP, General Electric, 3 phase, 60 cycle, 440 volt, 450 RPM, type I, form M, slip ring motor

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 450 RPM slip ring

1—75 HP Fairbanks-Morse, type H, frame 105C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage

1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring

2—75 HP Fairbanks-Morse, 3 phase, 60 cycle, 2200 volt, 1800 RPM, slip ring motors

1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage, 900 RPM

1—G.E. factory built syn. M-G set 230 KW, 125 V, 600 RPM generator driven by 335 HP, 4600 V syn. motor complete with starting equipment and panels.

1—60 HP General Electric, 3-60-440V, 720 RPM, type I, form K

1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring

1—60 HP General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, type MT 556 slip ring motor

1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator rewound

1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring

1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage

2—50 HP Allis-Chalmers, 3-60-440V, 890 RPM slip ring

1—50 KW, Allis-Chalmers, factory-built, 3 bearing M-G set, 125 volt DC, driven by 75 HP, 3 phase, 60 cycle, 220 volt, 1165 RPM motor

1—50 HP General Electric 3-60-440V, 690 RPM, MT 546, slip ring

1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring

1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage

1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage

1—50 HP General Electric, 3-60-440V, 490 RPM, type I-M, slip ring

1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage

1—50 HP Allis-Chalmers, 3 ph, 60 cy, 550V, 860 RPM Sq. Cage

1—50 HP General Electric, type I-M, 3 ph, 60 cy, 440V, 720 RPM slip ring

1—45 KVA Fairbanks-Morse, 3 ph, 60 cy, 220V, 1200 RPM alternator

2—30 HP Fairbanks-Morse, 3 ph, 60 cy, 220V, 3600 RPM, type HO, frame 12B ball bearing

2—drag generators, 15 KW. Westinghouse, SK111, 125 V. 450/1800 RPM gear head, ratio 10 to 1, used a few months.

2—175 HP, 230V, DC Westinghouse, type SK, 150 to 550 RPM

1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM

1—60 HP Westinghouse, type SK140L, 115V, 1150 RPM vertical

1—50 HP Westinghouse SK200, 230V, 250/900 RPM

2—40 HP, G. E., 3 ph, 60 cy, 440V, 435 RPM, type 1-13A

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25 cy-440V, 720 RPM, type MS, Sq. Cage

1—50 HP General Electric, 3-25 cy-440V, 700 RPM, type I-M, slip ring

1—40 HP Westinghouse 3-25 cy-440V, 730 RPM, type CI, frame 753A slip ring crane

1—35 HP Allis-Chalmers 3-25 cy-440V, 720 RPM, slip ring

1—30 HP Westinghouse 3-25 cy-440V, 720 RPM, CS, Sq. Cage

The Wente Electric Co.

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

CHICAGO'S LARGEST STOCK GUARANTEED EQUIPMENT

MOTOR GENERATOR SETS

KW	Make	DC	Volts	AC Volts
1500	Wtg.	250	Syn.	3/60/2300
1200	G.E.	280	Syn.	3/60/4100
1000	G.E.	250	Syn.	3/60/4150
1000	G.E.	600	Syn.	3/60/2300
1000	Wtg.	275	Ind.	3/60/4100
750	Wtg.	275	Syn.	3/60/440
235	Wtg.	125	Syn.	3/60/2200
225	Ideal	125	Syn.	3/60/2200
200	Elliott	125	Ind.	3/60/2200
150	Al. Ch.	250	Syn.	3/60/2300
100	Al. Ch.	125	Syn.	3/60/440
100	Wtg.	250	Ind.	3/60/440
100	Wtg.	250	Ind.	3/60/2200
100	G.E.	250	Ind.	3/60/2200
75	G.E.	250	Ind.	3/60/440
75	G.E.	125	Syn.	3/60/220
60	Al. Ch.	110	Ind-	3/60/2200
50	G.E.	250	Ind.	3/60/440
25	G.E.	230	Ind.	3/60/220
22½	G.E.	125	Ind.	3/60/220
15	Ideal	220	Ind.	3/60/220
10	G.E. 115/230			Balancer set
7½	G.E.	60	Ind.	3/60/440
7½	Jen. 115/230			Balancer set
	Roth 125/250			Balancer set
3½	G.E.	230	Ind	3/60/220
	Lincoln	115	Ind.	1/60/220
3	Lincoln	115	Ind.	1/60/220
3	Westg.	25	Ind.	3/60/220
2½	Acme	45	Ind.	3/60/220
2¼	Wotton		Ind.	1/60/110/220
2.4	Lincoln	80	Ind.	3/60/220
3 HP	Roth	110	2 KVA	1/60/110
2	El Sp.	750	Ind.	3/60/440
1	Holts. C	65		220 D.C.
.6	Rob. M.	115		Variable voltage
.378	G.E.	110	Ind.	1/60/110
.250	Robbins	125	Ind.	1/60/125
.250	Roch.	120	Ind.	1/60/110/220
.2	G.E.	6		115 v. d.c.
.2	G.E.	6	Ind.	1/60/110/220

FREQUENCY CHANGERS

1400 HP General Electric type ATI-24-1250M-300, form C, 3 ph., 60 cy., 460 volt, 300 RPM, 1570 amps., 1250 KVA, 0.9 P.F. 50° synchronous motor with amort. wdg.; dir./conn. to 1000 KW General Electric type ATI-10-1250M-300, 3 ph., 25 cy., 460 volts, 300 RPM, 1570 amps., 1250 KVA, 0.8 P.F. 50° A.C. generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter. (This is a three brg. unit suitable for operation from either end.)

40 KW Howell, SR-5454, 3 phase, 60 cycle, 440 volt to 40 HP 3 phase, 25 cycle, 40 volt, SC-443, .8 p.f., 750 GM, 4-brg. set.

SLIPRING MOTORS
3 Phase, 60 Cycle

Qu.	HP	Make	Type	Speed
2	2500	G.E.	MT	253
1	1000	Westg.	CW	450
1	1000	Westg.	HR	360
1	1000	G.E.		400
1	850	Allis. Chal.		1180
1	800	Westg.	CW	360
2	800	Westg.	CW	507
1	800	Westg.	CW	900
1	750	Allis. Ch.		440
1	750	G.E.	I-P	900
1	700	G.E.	MT-10	710
1	600	Westg. with drive		350
1	600	Westg.	CW	390
1	500	G.E.	MT412	435
1	500	G.E.	MT412	450
1	450	G.E.	MT412	600
1	400	Westg.	CW	435
1	400	Allis Chal.		600
1	400	G.E.	I-M	720
1	400	G.E.		1200
1	400	G.E.	IP	1800
1	350	Allis Chal.		300
1	350	G.E.	MT	300
1	350	G.E.	I-M	900
1	300	G.E.	I-24	293
1	300	Westg.	CW	400
1	300	G.E.	I-P	450
1	300	G.E.	MT-410	450
1	300	Westg.	CW	500
1	300	G.E.	I	514
1	300	G.E.		720
1	250	Westg.	CW	435
1	250	Cr. Wheeler	SR27QB	600
1	250	G.E.	IM	435

SQUIRREL CAGE MOTORS
3 Phase, 60 Cycle

Qu.	HP	Make	Type	Speed
1	1000	G.E. 2200 v.	K	509
1	700	G.E. 2200 drip-proof cons.	KF	1800
1	600	Fair. Morse	H2	212
1	500	G.E.	IK	1200
1	500	Westg.	CS	1750
1	400	Allis. Chal.		600
1	400	G.E.	I-M	950
1	400	G.E.	I-K	1800
3	250	Westg.	CS	350
1	250	Ideal	A	1200
4	250	Fair. Morse	BB	1800
1	225	G.E.	I-E	1800
1	225	G.E.	FT	3600
1	200	Allis Chal.	AN	347
1	200	Fair. More		514
1	200	Westg.	CS	600
1	200	G.E.	IK	600
1	200	G.E.	KT566	720
3	200	G.E. 2200 v.		1800
3	200	Fair. Morse	BB	1800
1	200	Westg.	CS	3600
2	200	G.E.	KTP	3600
1	150	Allis Chal.		570
1	150	G.E.	IK	600
1	150	Westg.	CS	1800
2	120	G.E.		720
2	150	G.E.	I-K	720
1	150	Allis Ch.		850
1	150	G.E.	K-558	900
1	150	Westg.	CS	1800
4	125	G.E.	KT	720

TRANSFORMERS

No.	KVA	Make Type	Pri.	Sec.
2	200	G.E. 3 ph. Auto. HT	4000Y	2300Y
1	100	G.E. 3 ph. 25 cy. HT	9000	230
1	75	Darling Auto H. 182	10	250
2	75	West. S	3810	244/122
3	75	West. SK	3810	244/122
1	30	Kuhlman 3 ph.	210/220/230	55/100
1	15	Ft. W. A.	1050/2100	2200/288
1	10	Moloney HE	1100/2200	220/440
1	7½	G.E. H	1100/2200	244/488
1	7½	G.E. 3 ph. HT	2300/3810	220/440
1	7½	Pitts. HE	2200	110/220
1	7½	G.E. 3 ph HT	6600	230
1	6	Sorgel 3 ph. SO	140	228
1	5	G.E. H	1100/2200	220/440
1	3	Moloney HE	2200	110/220
1	3	Moloney HE	1150	115/230
8	3	G.E. H	220/440	55/110
1	1½	Al. Ch.	2200	110/220

BOILER

300 HP Keeler, reinsurable 200 lbs. with chain grate stoker, can release at once.

3—100 KVA New Moloney, type CL, single phase, 60 cycle, 33000 volts primary, 480/220 volts secondary.

TURBINE

100 HP Terry steam turbine, 125 lbs. for 3 phase, 60 cycle, 240 volt operation, 3600 RPM, fine condition.

Have large stock other sizes and speeds. Motors, Generators, Pumps, Transformers. NEW factory distributors, can furnish many new items from stock.

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POWER PLANT EQUIPMENT CO., Inc.

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New York, N. Y.

A C TURBINE UNITS

6250 KVA G.E., 2300 V., cond.
3750 KVA Wghse. 600 V. BLEEDER.
3125 KVA G.E., 4100/2300 V. cond.
3125 KVA G.E., 480 V., BLEEDER.
2500 KVA G.E., 2300 V. cond.
2500 KVA Al. Chal. 440 V. cond.
1875 KVA G.E., 2300 V. cond.
1553 KVA Al. Chal. 480 v. Cond.
1500 KVA G.E. 600 V. Cond.
1250 KVA (2) G.E., 2300 V. cond.
937 KVA G.E. 2300 V. Cond.
625 KVA Wghse. 2300 V. cond.
375 KVA G.E., 2300 V. cond.
312 KVA Elliott 480 v. cond.
250 KVA Al. Chal.-Elliott Kerr, 240 v.
150 KVA Wghse. 240 V. cond.

(NON COND.)

375 KVA G.E., 2300 V.
312 KVA C.W.—Moore, 450#, 240 V.
280 KVA E.M.-Terry.
75 KVA Al. Chal. 240 V.
190 HP Wghse. 375# Turbine.
150 HP Terry. 225# Turbine.

BOILERS

850 HP B&W W. T. Boiler 250# with Riley Stoker.
749 HP (2) Edgemoor, 200#
728 HP Erie City, Ver. 200#
612 HP Sterling 250# Chain Gr. Stoker.
522 HP Kidwell 207#, 3 drum.
512 HP (2) B&W 200#. Stokers.
471 HP Erie City Ver., 160#
396 HP B. & W., 160#
300 HP (2) Union Iron Wks. Cross drum 175#
287 HP (2) B&W 160#
259 HP (3) Wicks ver.; 160# pulverizers.
255 HP Casey-Hedges 160#

DIESEL ENGINE SETS

375 KVA Wghse.—Busch Sulzer
312 KVA G.E.—Anderson
312 KVA G.E.—McIntosh Sey.
300 KVA Fairbanks-Morse "VA"
200 KVA G.E.—Busch Sulzer.
125 KVA Ideal-Primm
105 KVA Ideal-Primm.
100 KVA C.W. Bessemer
90 KVA (4) F.M.—F.M. "VA"
75 KVA Al. Chal.—International

SPECIAL

287 HP. (2) B&W Boilers 160#.
300 KVA Fairbanks Morse "VA" Diesel engine unit.
250 KVA G.E. 3/60/240 V—Nordberg uniflow unit.
300 KVA Allis Chalmers 3/60/240 V.—Elliott Kerr Turbo, non-cond.
75 KVA (3) G.E. Transformers, 2400-120-240 v.

STEAM ENGINE SETS (A C)

675 KVA Burke—24 x 36 Norberg Unif.
480 KVA Al. Chal.—Corliss 4 V.
375 KVA G.E.—22 x 27 Erie Ball, 4 V.
312 KVA Wghse.—21x22 Skinner Unif.
300 KVA G.E.—Amea UNIFLOW (Twin)
250 KVA G.E.—Nordberg UNIFLOW.
175 KVA Wghse.—Ames UNIFLOW.
150 KVA G.E.—16 x 16 Skinner S.V.

PUMPS (MOTOR DRIVEN)

8000 GPM Al. Chal. 132' head.
7500 GPM 80' head.
5500 GPM Buffalo 50' head.
3600 GPM 85' head.
3250 GPM 425' head.
3000 GPM 100' head.
3000 GPM (2) 65' head.
1200 GPM Al. Chal. 65' head.
1000 GPM Morris 255' head.
725 GPM Wheeler 30' head.
350 GPM 720' head.

STEAM ENGINE SETS 250 V.

450 KW C. W.—Nordberg Unif.
400 KW G.E.—Ridgway 4 V.
300 KW G.E—Skinner Unif.
250 KW C.W.—Skinner UNIFLOW.
150 KW G.E.—Erie Ball 4 V.
100 KW G.E.—Erie Ball 4 V.

AIR COMPRESSORS

2200 CFM Nordberg 100#, Steam and Motor Driven.
1000 CFM Nordberg 85#—Motor.
1080 CFM Nordberg, 100#—Motor.
500 CFM Ingersol 100#

SYNCHRONOUS CONDENSER

5000 KVA Wghse. 3-60-2300/4000 V. 900 RPM, with starting apparatus.

GAS ENGINE UNIT

1000 KVA G.E. 3-60 2300 v.—1200 HP. Rathburn Jones Gas Engine.

REBUILT POWER EQUIPMENT

READY TO SHIP!

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
5	G.E.	440	1200	MT
20	Westg.	220	1735	CW
50	Westg.	440	1145	HF
50	Chandeys'n	220/440	1800	
50	Allis Chal.	220	490	
54	Allis Chal.	440	900	
75	G.E.	440	1200	I-M
75	West.	220/440/2200	580/290	CW
100	West.	220/440	685	CW
150/75	West.	220/440/2200	580/290	CW
150	West.	2200	375	CW
150	West.	2300	490	CW
150	West.	220/440	490	CW
185		2300	900	
260	Burke	440	600	EMV-65
300	G.E.	440	900	I
400	Westg.	2300	580	CW
400	Westg.	2200	435	CW-1214
1500	Westg.	2200	435	CW

ALTERNATING CURRENT MOTORS

3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
25	West.	220/440/550	1200	CS
25	G.E.	220/400	580	KF
30	G.E.	440	1800	KT
30	Linc. Elec.	220	600	
30	Duquesne	440	600	
30	Triumph	220	525	TR-138
30	Allis Chal.	220/440	1200	
35	Lincoln	220	720	
40	Howell	220	900	SO
40	Linc. Elec.	220	900	
40	Duquesne	220/440	850	
40	G.E.	440	1800	KT-527-4
50	Fair Morse	220	900	
50/150	West.	2200	360/720	CS-954
50	West. El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Cr. Wh.	240/480	1200	Syn.
50	Allis Chal.	440	1800	AN
50	G.E.	220/440	1200	HI
50	G.E.	440	1200	
50/32	G.E.	440	800/640	
60	G.E.	440	1800	
75	Louis Allis	220/440	1770	505Y
	Adjusto speed—splash proof—ball bearing			
75	West.	2200/220/440	720	CS
75	West.	2300	1200	Syn.
100	Allis Chal.	220	1750	
100	Allis Chal.	220	600	
150	Wagner	440	1800	31V
150	G.E.	2200/220/440	450/243	
175	G.E.	2200	600	I-12
200	Westg.	2200	900	
400	West.	2200/220/440	500	CS
1000	G.E.	2300	509	K
1500	G.E.	2200/220/440	225	ATI-Syn.
3500/4000	West.	4000/23000	900	Syn.

HOIST

1—3 ton Westinghouse Hoist with Westinghouse DC Motor, 1600 rpm.

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
2¼	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
2¾	Westg.	900/1800	SK
3	Jantz-Liest	650/1950	BI-DC
3	Roth (Enclosed)	500/1000	RS
3¼	West.	400/1600	SA
3½	Westg.	850/1700	
5	Reliance	300/1800	21
7½	Westg.	450/900	80L
7½	Reliance	650/1300	550v.
7½	Westg.	1125/2905	SK-43
7½	West.	400/1600	SA
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
15	Louis Allis	1150/1750	NA
15	Reliance	500/1800	
15	West.	675/1350	SK-100L
20	Westg.	750/1500	SK-110L
20	Westg.	750/1125	SK
30	G.E.	450/900	RLC
35	G.E.	375/1400	IC
50	G.E.	600/1200	500 v.
75	West.	475/950	SK-180
75	West.	400/650	SK-181
200	G.E.	220/350	MP
200	West. Elec.	220/350	LL-7
250	G.E.	220/320	MP
250	West. Elec.	220/320	LL-7

TRANSFORMERS—1 ph. 60 cy.

No.	KVA	Prl.	Sec.	Make
1	2	6600	110/220	G.E.
3	5	2300	220/440	G.E.
1	5	550	110	Pgh.
1	5	2200	110/220	West.
84	7½	2200	220/110	G.E.
32	7½	2200	220/110	West.
12	10	2200	220/110	West.
13	10	2200	220/110	G.E.
2	15	400/30000/50000		American
1	25	2200	220/110	G.E.
6	35	220	110	West.
3	37½	2200	440/220	West.
3	50	6600	575/440/220	G.E.
2	50	6600	550/440	Pgh.
2	50	6600	550/440	Al. Ch.
2	150	2400	240/480	Allis Chal.
6	73	2200/4000	220/110	West.
6	73	440	205	West.
1	75	2200	220	Burke
6	75	2200	220/440	West.
3	150	2400	240/480	Allis Chal.

INDUSTRIAL TRUCKS

1—Baker Tow Truck with batteries.
1—4000 lbs. Automatic Lift Truck, 50" lift. Platform is 26" x 51½". Overall length of truck 115".

D.C. CLARK CONTROLLER

1—250 HP Clark Vari-time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

MOTOR GENERATOR SETS

250 volts

1—5 kw. Allis Chalmers 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—7½ kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—10 kw. West. SK 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—15 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—20 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—25 kw. Triumph 1750 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—25 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—100 kw. 250 v. DC G.E. Gen. dir. conn. to 2200 v. 3 ph. 60 cy. G.E. Syn. Motor.
1—150 kw. West. 250 v. 900 rpm. Gen. dir. conn. to 290 HP 440 v. 3 ph. 60 cy. West. Syn. Motor.
3—250 kw. Cr. Wh. 250 v. 500 rpm. DC Gens. with 3—250 kva. Cr. Wh. Syn. 2200 v. 3 ph. 25 cy. Motors.

125 volts

1—3 kw. G.E. 1800 rpm. Gen. direct driven by 220/440 v. AC Induction Motor.
1—5 kw. 125 v. 1150 rpm. Allis Chal. Gen. dir. conn. to 3 ph. 60 cy. 220/440 v. AC Induction Motor.
1—50 kw. G.E. 1200 rpm. Gen. direct driven by 2200/440/220 v. AC Induction Motor.
1—100 kw. 125 v. West. Gen. with 2300 v. 3 ph. 60 cy. 1200 rpm. West. Syn. Motor.

500 volts

1—200 kw. West. 600 v. DC 900 rpm. Gen. dir. conn. to 290 HP 440 v. 3 ph. 60 cy. West. Syn. Motor.

A.C. GENERATORS

62½ KW Westg. 3 ph. 60 cy. 240/440/2300 v. 1200 rpm.
360 KVA West. 220 v., 3 ph. 60 cy., 360 rpm.

SPEED REDUCERS

1— 36 HP Cleveland Model 150, size 900 AT, ratio 43:1.
1— 40 HP W. A. Jones 480 rpm. ratio 9.143:1.
2— 50 HP W. A. Jones 575 rpm. ratio 9.143:1.
1— 75 HP W. A. Jones 875 rpm. ratio 9.143:1.
1—100 HP W. A. Jones 1150 rpm. ratio 9.143:1.
1—125 HP Nuttal, single reduction, ratio, 1.6:1 450 rpm.
1—150 HP Nuttal, single reduction, ratio 1.6:1.
1—175 HP Jones 1750 rpm. ratio 9.143:1.
2—180 HP Cleveland size 1000 AT ratio 9-2/5:1.
1—225 Nuttal, ratio 1.6:1.
1—300 HP Nuttal, ratio 1.6:1.
1—400 HP Nuttal, ratio 1.6:1.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS—SEND FOR STOCK LIST.
LIST YOUR IDLE EQUIPMENT WITH US.

DUQUESNE ELECTRIC MFG. CO. Pittsburgh 6, Pa.

GOOD VALUES—ALWAYS

120, 240, 280, 360 HP Fairbanks Diesels.
250 KVA McIntosh Seymour Diesel Gen.
300 KW 400 HP Nordberg Diesel Generator.
375 and 500 HP Fulton Diesel Generators.
2—375 HP Busch Sulzer Diesel Generators.
50 HP to 1200 HP Diesel Units—Various makes.
800 KW Natural Gas engine Generator.
2—80 HP Steel Cased HRT Boilers.
2—84"x20' HRT 260 HP Steam Boilers.
10 to 75 ton Steel Derricks—Guy & Stiffleg.
1500 to 3000 cfm Motor Driven Compressors.
25 Ton Standard Gauge Locomotive Cranes.
35 Ton Plymouth Gasoline Locomotive.
1—1¼ Yd. P & H Gas Crawler Crane & D/L.
Water Tube Boilers—Air Compressors.
Steel Sheet Piling—Pile Hammers, etc.

Mississippi Valley Equipment Co.
507 Locust St. St. Louis 1, Mo.

ELECTRICAL EQUIPMENT

FOR

INDUSTRY

LET US KNOW YOUR REQUIREMENTS

150 KW MOTOR GENERATOR SET

150 KW Westinghouse "factory built" Synch. Motor Generator Set. Type SK Generator for 250 volts DC compound wound interpole, 225 HP Type G Synch. Motor for 3/60/2300 volts, speed 900 RPM, complete with Westinghouse Switchboards.

For Details, Write

JOHN D. CRAWBUCK CO.
710 Empire Bldg., Pittsburgh 22, Pa.

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—4000 KW. 2300 V. Cond.
1—2500 KW. 480 V. Ext. Cond.
1—2000 KW. 600 V. Cond.
1—1500 KW. 2300 V. Cond.
1—1250 KW. 480 V. Cond.
1—750 KW. 2300 V. Cond.
1—750 KW. 600 V. Cond.
1—500 KW. 125 V. D.C. Cond.
1—200 KW. 2300 V. Cond.
1—120 KW. 440 V. Von. C.
1—75 KW. 125 V. Non. C.

TURBINES ONLY

1—210 H.P. Terry 250#
1—100 H.P. G.E. with gears

ENGINE GENERATORS

1—600 KW. 2300 V.
1—125 KW. Uniflow 600 V.

BOILERS

1—2100 H.P. 350# Stoker
4—1000 H.P. 250# Oil
1—480 H.P. 225#
1—300 H.P. 225# Stoker
2—300 H.P. 160# Oil
1—200 H.P. 450# Oil
1—168 H.P. 150# Oil
1—150 H.P. 150# H.R.T.

AIR COMPRESSORS

1—6700 C.F. 22# Turbine Driven
1—1600 C.F. 50# Steam Driven
1—1315 C.F. 30# Steam Driven
1—1214 C.F. 100# Motor Driven
1—600 C.F. 350# Steam Driven
1—386 C.F. 100# Steam Driven
1—105 C.F. 350# Motor Driven

PUMPS

1—3000 GPM 65' Hd Motor
1—1000 GPM Fire Pump Steam
1—750 GPM Fire Pump Steam

CONDENSERS

1—6000 Sq. Ft. Surface
2—2212 Sq. Ft. Surface
1—3200 Sq. Ft. Surface
1—1485 Sq. Ft. Surface

Write or wire for additional data and prints.

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The Buyer Must Be Satisfied—Always

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

25 Cycle—3 Phase—2200 Volts

1—100 HP, Allis-Chalmers, type AR. Ball Bearing, 1500 RPM, Serial # 42209K426N-1-1

3—150 HP, Gen. Elect. Ball Bearing type KT557Y 1500 RPM, Serial # over 5 million

MOTOR GENERATOR SETS

1—40 KW Gen. Elect. 230 V. DC. Type DLC. Direct connected to 50 HP. Gen. Elect. KT. Motor 3/60/440 V. 720 RPM.

1—125 KW Ridgeway 250 V. DC. 1200 RPM. direct connected to 180 HP. Ridgeway Motor. 3/60/440 Volts 1200 RPM. DC. Panel and Starting Compensator.

SPECIAL OFFER

1—100 KW. Ridgeway Synchronous. 250/275 V. DC. 1200 RPM. motor 150 HP. Sync. 3/60/2200 V. 1200 RPM. DC. Panel and Sync. Starting Equipment. Price $2750.00 F.O.B. Cars.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 362½/440 V. Complete with exciters and panels.

25 CYCLE SYNCHRONOUS MOTOR

1—100 HP. Electric Machinery Co. Synchronous. Motor 3 phase 25 cycle 440 Volt 300 RPM.

SPECIAL

1—30 HP. Westinghouse type C.S. Motor, 3 phase 25 cycle 440 Volts 1500 RPM.

TRANSFORMERS

3—150 KVA. General Electric Type H, Form KS. 2400 Volts Primary 120/240 Volts Secondary.

60 CYCLE MOTOR

1—200 HP. Electric Machinery Synchronous Motor, 3 phase 60 cycle 440 Volt, 720 RPM.

REBUILT MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
7½	General Electric	KT952	1200	4593120
7½	Fairbanks-Morse	HJ-10BB	900	157685
7½	Fairbanks-Morse		1200	476598
10	Westinghouse	CS	900	2174616
10	Star	BB	3600	90847
15	U. S.	STB-BB	720	55379
15	Crocker Wheeler		600	131413
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	944593
20	Westinghouse	CS	1200	2160590
20	Star	BB404	1200	10581
20	Westinghouse	MS	1200	1056826
20	Westinghouse	MS	1200	1246745
20	Westinghouse	MS	1200	1056827
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	1930159
20	Westinghouse	CS	1800	2695044
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1334763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
30	Armor	BB	720	4343
30	Crocker Wheeler		720	17270
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43476
40	Westinghouse	CCL	350	581480
40	Westinghouse	CS	900	1896969
40	General Electric	I-K	1800	73318
40	General Electric	I-K	1800	68511
40	General Electric	I-K	1800	77017
40	General Electric	I-K	1800	73316
40	Westinghouse	MS	1800	1506800
40	Westinghouse	MS	1800	1051548
40	Westinghouse	MS	1800	1056802
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
50	Westinghouse	CCL	400	541841
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	Westinghouse	CS	1800	2691183
50	Westinghouse	CS	1800	1949877
50	General Electric	14	1800	181444
50	Reliance		1800	Z20194
50	Allis Chalmers		1800	3K28825
60	Westinghouse	CS	900	4884402
60	Reliance		1200	B11458
60	Westinghouse	CCL	450	518408
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
75	Westinghouse	CCL	514	450185
75	Westinghouse	CCL	1200	1032102
75	Lincoln		1200	19792
75	Allis Chalmers		1200	2KA5828–1
75	Westinghouse	CS	1800	2134671
100	Westinghouse	CCL	600	416173
100	Westinghouse	CS	900	2207524
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	Westinghouse	CCL	720	427284
125	Westinghouse	CS	1200	2318625
150	Westinghouse	CS	1800	2429726
150	Westinghouse	CCL	900	438385
150	General Electric	KT557	1200	5269860
150	General Electric	KT557	1200	5260126
150	Westinghouse	CS	1200	4572596 (2200 v.)
150	General Electric	I-K	720	122809 (2200 v.)
150	Westinghouse	CCL	720	808349 (2200 v.)
200	General Electric	I-K	900	232917 (2200 v.)
200	Westinghouse	CCL	900	919537 (2200 v.)
250	General Electric	I-K	600	224683
300	General Electric	I-K	720	2357743
400	General Electric	I-K	900	2347845

SLIP RING MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
1	Westinghouse	CW	1200	5348371
1	General Electric	MT122	1200	232163
1	General Electric	MT122	1200	3797628
1	General Electric	MT122	1200	2323624
1½	General Electric	MT140	1200	1416002
1½	General Electric	MT140	1200	811798
15	General Electric	I-M	900	1225064
15	General Electric	MT322	855	3088717
13	K.W. Sachsenwerk	D7–3/8	850	295481
20	Westinghouse	CW644C	575	8009992
20	General Electric	MT332	545	3889010
30	Westinghouse	HF	1745	1558408
40	Westinghouse	CW748	690	4406823
40	Westinghouse	CW748	690	4406825
40	Westinghouse	CW748	690	4406821
40	Westinghouse	CW748	690	4406819
40	Westinghouse	CW748	690	4405824
250	Allis Chalmers	3 bearing	505	104390 (2300 v.)
400	General Electric	I-M	900	224674
400	General Electric	I-M	900	246762

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WE ARE NOW DISMANTLING THE BROOKLYN EDISON GENERATING STATION—66th St. and Shore-Road, Brooklyn, N. Y.

1—Shaw Traveling Crane 25 Ton capacity 68 ft. span
1—450000 gallon water storage tank 30' x 85'
1—15000 KW G. E. TURBINE GENERATOR SET
2—12,500 KW Westinghouse TURBINE GENERATOR SETS
3—20,000 square ft. Cast Iron Wheeler Condensers

3—30,000 gallon circulating Pumps
3—12,000 gallon Centrifugal Pumps
Condensate Pumps, Air Pumps, Centrifugal Pumps, Steam Pumps
6—450 HP Boilers with underfeed Stokers
6—500 HP B&W Boilers with underfeed Stokers
2—450 KVA Transformers
6—60 KVA Reactors
3—50 KVA Reactors
1—250 HP Motor Generator Set
Traveling Water Screens
Coal Conveying Equipment, Ash Cars, Coal Cars, Buckets, Rail, Hoppers
1—Gould 60 Cell Storage Battery Plant
27—Oil Circuit breakers, disconnect switches, Ammeters, Volt Meters, Electric Motors and Pumps, Bus Bar Equipment, Switch-board Equipment, Copper Wire, Knife switches, electrical equipment
Electric Motors, Pipe, Fittings, I-Beams, and other Power plant equipment.

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PAUL STEWART and COMPANY

HEAVY POWER PLANT EQUIPMENT — CINCINNATI

SPECIAL OFFERINGS NON-CONDENSING TURBOS

1—1500 KW G.E. 3/60/2300V/225#-15# B.P.

1—1000 KW Wemco 60/3/2300V/1800 RPM/150#-10# B.P.

1—1000 KW Wemco turbine only. 375#, 700° T.T. Good condition

1—625 KW-780 KVA Wemco Parsons 60/3/480V, 200#-5# B.P. 100° S.H.

1—600 KW Wemco Parsons 60/3/440V/140# ISP

1—500 KW-625 KVA Wemco mult. expans. parallel flow 60/3/440V/3600 RPM 150-200#-10# B.P.

1—400 KW-500 KVA 60/3/480V/150#-5# B.P. with reduction gear. Used only 3 mos.

COND. TURBOS

12,500 KVA 2-6250 KVA Wemco 76 CW frame, 60/3/2300/200# equal new.
5,000 KW G.E. Curtis 5 stage Cond.
4,000 KW G.E. 60/3/2300V, 200# 125° S.H. jet or surface cond.
2,000 KW Wemco 60/3/440V/180#, surface cond.
1,250 KW Wemco Cond. or Bldr. 60/3/480V/150#/120° S.H. /3600 RPM economical Cond. Bldg. 15# G. 15,000# per hr.
1250 KVA Allis A.C. 60/3/2300/3600 RPM 150-200#, 100° S.H. with jet condenser, all aux. Rugged turbine, price low.
1560 KVA Wemco A.C. 60/3/600/3600 RPM, with mixed flow regulator and Wemco 42 sq. ft. surf. cond.
300 KW Wemco high speed 60/3/2400V. All aux. including boiler complement.
SPECIAL: 1—3000, 1—2500 KW G.E. power generating plants, complete with code boilers. Condition good.

ASME BOILERS

1—1250 HP steam generation plant, complete. Superheater, Economizer, Steel encased with 14 retort underfeed stoker, 100,000# continuous.
2—612 HP 200# 125° S.H. Stirling.
4—500 HP Heine 190#, 150° S.H.
2—500 HP B&W 200# 100° S.H. with Comb. Eng. Type E. stokers; all auxs.
3—400 HP 1—500 HP Casey Hedges; oil fired.
2—365 HP Edgemoor 200# 100° S.H. ASME ramy type stoker.
3—354 HP Stirling 160# all aux. ASME Detroit underfeed stokers.
2—352 HP 225# 3 drum, bent tube, with oil burners, new in 1937 used 1 year.
3—316 HP Heine horizontal 170# waste heat.
1—313 HP 250# Edgemoor, 125° S.H. with stoker.
2—300 HP Stirling 170# 100° S.H. B&W ASME
2—200 HP Bigelow HRT 130#, Huber stokers.

DIESEL ENGINES AND GENERATING SETS

1—1100 HP Diesel generating power plant 60/3/2300V.

1—360 HP Anderson Type KD heavy duty engine Burke 60/3/2400 V gen.

1—225 HP Model 68-CP full Diesel 6 cyl. 4 cycle, mech. inject. to V belt drive. New 1941.

1—150 HP F-M Type Y, Cycle V, 3 cyl. 257 RPM 240 V. DC Wemco gen.

1—100 HP F-M, 2 cyl. DC Bullock Elec. Gen. 240 volts, 300 amps. 275 RPM.

50 YEARS OF SERVICE

LET US PLACE YOUR MODERN IDLE EQUIPMENT

M-G Sets 3 ph. 60 cy. (Syn.)

150 KW G.E. 250 v. cpd. wd. Gen. with interpoles, 900 RPM direct con. to 225 HP. G.E. Syn. Motor Type ATI 2300/3/60 900 RPM. with AC and DC Panels.
100 KW West. 125 v. Type SK 170L cpd. wd. Gen. with interpoles, 1200 RPM. dir. con. to 150 HP. West. Syn. Motor 2300/3/60 1200 RPM. with AC and DC Panels.
100 KW 250 v. G.E. CL 900 RPM—150 HP G.E. Syn. 2300/3/60 900 RPM with AC and DC Panels.
100 KW G.E. 250 v. Type CL 900 RPM belted to 150 HP West. CCL sq. cg. motor 220/440/3/60 600 RPM.
100 KW Ridgway 250/275 v. DC Gen. cpd. wd. with interpoles, 1200 RPM. dir. con. to 150 HP. Ridgway Syn. Motor 2300/3/60 1200 RPM. with AC and DC Panels.
50 KW. G.E. Type BR 125/150 v. 1750 RPM. dir. con. to 75 HP. G.E. KT 220/440 v. 3 ph. 60 cy. 1800 RPM. with starting equipment.
50 KW West. SK 275 v. 900 RPM dir. con. 75 HP West. sq. cg. motor 220/440 v. 3 ph. 60 cy. 900 RPM.

CAPACITOR

180 KVA General Electric, 2300/3/60 Type OH 1.

SYN. CONDENSER

5000 KVA Westinghouse 4000/2300/3/60 900 RPM with dir. con. exciter (Late Type).

WELDING M.G. SETS

150 amp. Lincoln with 220/440 v. Motor.
300 amp. Lincoln Stable Arc with 440 v. Motor.
600 amp Lincoln Shield Arc with 440 v. Motor.

AC & DC GENERATORS

160 KW G.E. AC 2300/440/220 v. 3 ph. 60 cy. 720 RPM.
150 KW West. 250 v. 450 RPM Type S cp. wd.
100 KW West. Type SK 250 v. 900 RPM.
100 KW G.E. Type CL 250 v. 900 RPM.
75 KW G.E. Type DLC 125 v. 700 RPM.
50 KW G.E. Type BR 150 v. 1750 RPM.
50 KW West. SK 250 v. 900 RPM.

AC & DC STEAM ENGINE GENERATOR SETS

50 KW West. 125 v. 300 RPM cp. wd. dir. con. Skinner R.H. Engine.
75 KW G.E. 125 v. 275 RPM cp. wd. dir. con. to Skinner Center Crank Engine.
100 KW West. 250 v. 250 RPM cp. wd. dir. con. to Skinner Engine.
150 KW Cr. Wh. 3 wire 125/250 v. Skinner Universal Unaflow Engine.
200 KW Cr. Wh. 3 wire 125/250 v. Ames Una-Flow Engine.

STEAM TURBINES

2—1 KW Frick & Lindsay 110 v. DC.
87½ KVA Al. Ch. 220/3/60 3600 RPM Gen. with 80 HP. Kerr Turbine.

ROLLING MILL DRIVE

500 HP G.E. Type MT 412 slip ring 2300/3/60 435 RPM 3 bearing with starting equipment including Morse Chain Drive 84" centers, ratio 4.28 to 1, motor sprocket 25 Teeth, 14" face, 7" bore, 2" pitch, large split sprocket, 107 Teeth, 14" bore, including oil tight steel enclosure and oil pump.

AC MOTORS 3 ph. 60 cy.

Synchronous

HP	Make	Type	Speed	V.
200	West.	8 P. F.	900	2300
150	West.	ATI 8 P.F	900	2300

Each with dir. con. exciter.

Slip ring

1500	West.	CW	435	2200
500	G.E.	MT 412	450	2200 v. 3 brg
300	West.	CW	495	2200
200	G.E.	IM	514	2200
200	G.E.	MT 412	240	2200
150/75	West.	CW	580/290	2200/220/440
150	West.	CW	580	2200/220/440
150	West.	CW	375	2200/440/220
125	Al. Ch.		435	2200
100	Al. Ch.		575	2200
100	G.E. (25 cy.)	MI 108	500	220/440
75	West.	CW	290	2200/220/440
75	West.	CW	580	2200/220/440
50/12½	G.E.	IM	450/900	2200
50	G.E.	IM	900	2200
37	Otis	Int. rated	1140	220/440
20	West.	CI 556	900	220/440
15	G.E.		900	220/440

Squirrel Cage

1000	G.E.	KT	514	2200
150(2)	West.	CCL	600	220/440
100	G.E.	IK	1200	220/440
100	West.	CS	580	220/440
75	West.	CCL	900	220/440
50	Triumph	B	720	220/440
40	Elliott		1200	220/440
30	Al. Ch.		1200	220/440
30	Al. Ch.		860	220/440
25(2)	West.	CCL	845	220/440
25/7½	Cr. Wh.	119 AQ	1170/585	2200
20	West.	CCL	1120	220/440
20	West.	CS 405	850	220/440

Reduction Units

2—5 HP Aetna Gear Drive Ratio 12 to 1.
25 HP Morse Silent Chain Drive.
30 HP Morse Silent Chain Drive.
150 HP Nuttal Ratio 1.6 to 1.
250 HP Ottumwa Ratio 12.7 to 1.
500/700 HP Morse Chain Reduction 84" centers 25 Tooth motor sprocket 14" wide, 2" pitch, 7" bore, large split sprocket 107 Teeth, 14" bore, including oil tight steel enclosure and oil pump.

DC MOTORS

Series Wound

HP	Make	Type	Speed	Voltage
2½	Niles	6 x 4	600	110
10	Niles	7 x 5	600	110
60	G.E.	CO 2507	600	230
100	G.E.	MD 108	480	230
130	G.E.	CO 1812 A	550	230
175	G.E.	MD 109½	475	230

Variable Speed

5 (2)	Reliance with Aetna Gear Drive.		500/1500	230
6½	G.E.	RC 26A	2500/3125	110
7½	West.	SK 100	500/1500	500
10	West.	S 6	565/1130	230
10	G.E.	RLC	400/1200	230
10	Cr. Wh.	CM	500/1500	230
20	Cr. Wh.	CCM	600/1200	230
25	West.	SK 130	600/1200	230

Constant Speed

15 (2)	West.	SK 100L	675	230
15	West.	M	650	110
20	West.	SK 100L	850	230
20	Northern		650	110
20	West.	SK 110L	750	230
25	Reliance	185 T	850	230
25	West.	SK 130	600	230
50	West	SK 160	565	230
100	G.E.	DLC	575	110
175	West.	S	320	230
105	G.E.	CL	700	230
250	G.E.	MP	220	230
250	G.E.	LL7E	220	230

AIR COMPRESSORS

1—355 cp. ft. 100# pre. Ing. Rd. Type ER 1, plate valve, 12" bore 10" stroke, with idlers. Equipped with either AC or DC Motor.
492 cu. ft. Chic. Pneu. simplate valve Type NS03 straight line, 16½" & 11"x18" 100# pres.

Transformers

Qu.	Kva.	Make	Ph.	P.V.	S.V.
3	50	G.E.	1	22000/2300	
2	25	G.E.	1	2300	244/488
1	25	Al. Ch.	1	2200	220/440
30	10	West. & G. E.	1	2200	122/244
27	7½	West. & G. E.	1	2200	122/244

MOORHEAD-REITMEYER CO., INC.

PITTSBURGH 19, PA.

PUMPS MOTOR & STEAM DRIVEN

G.P.M.	Head	Make	Type
9700	110'	Ing. Rand	Centrif.
6000	33'	LeCourtenay	Centrif.
3500	140'	Kingsford	Centrif.
2400	55'	American	Centrif.
1100	220'	Allis-Chalm.	Centrif.
1500	180'	Penna	Centrif.
1500	160'	De Laval	Centrif.
400	625'	LeCourtenay	Centrif.
250	525'	LeCourtenay	Centrif.
400	350'	Goulds	Triplex
300	500'	Goulds	Triplex
175	500'	Goulds	Triplex
500	175'	Blackmer	Rotary
450	231'	Kinney	Rotary
300	150'	Viking	Rotary
200	175'	Blackmer	Rotary
1000	460'	Knowles	Steam
750	460'	Snow	Steam
2000	50'	Lawrence	Sump
300	231'	Gardner	Plunger

M. G. & STEAM DR. SETS

K.W.	Make	Volts	Type
25	Geen Eng.	220	Belt Drive
100	Ames	240	dir. dr. Eng.
75	Ames	240/120	dir. dr. Eng.
17	Sturt. Turb.	110	Direct Drive
7½	Sturt. Turb.	110	Direct Drive

D.C. MOTORS ALL SIZES

100 Northwest	220	1750
85 Roth	230	1750
10 Crock. Wheel	110	925
10 Wesche.	110	1700

½ to 7½ H. P. ALL MAKES

CONDENSATION RETURN UNITS

Nash-Jenn Dup. Vac. Heat. 26000EDR
Nash-Jenn Simp. Vac. Heat. 16000EDR
Condensation Units 100 to 250,000EDR

AIR COMPRESSORS

C.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. Dup.
500	60	Ing. Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
250	100	Sullivan	Horiz.
125	100	Gardner	Vert. Dup.
173	100	Ing. Rand	Horiz.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

3000	16 lbs.	In. Rand	Motor dr.
3000	8 lbs.	In. Rand	Motor dr.
900	5¼ lbs.	In. Rand	Motor dr.
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24–48 oz.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS & EXHAUSTERS

C.F.M.	St. Pres.	Make	Type
100–60000	¼"–5"	Buffalo	Various
100–15000	¾"–16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
15000	2 lbs.	I-R-Turbo	Direct dr.
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
200	5 lbs.	Baker	Direct dr.
110	15 lbs.	Beach R	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth	Belt dr.
100	high vac	Beach R	Gear dr.
100	27 in.	Deane	Belt dr.
100	29 in.	Devine	Belt dr.

MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
300	G.E.	2300/4000	1800	Syn
150	West.	440	700	CS
125	G.E.	220	1150	Vertical
100	Lincoln	220	1750	
50	G.E.	2300	1750	I
50	West.	220	850	CCI
50	West.	220	570	CS
40	G.E.	220	870	342
30	Wagner	220	850	sl. rg.
10–30	All Makes			

SIMILAR EQUIPMENT IN STANDARD MAKES AND SMALLER SIZES
HIGHEST PRICES PAID FOR YOUR IDLE EQUIPMENT

SUPERIOR EQUIPMENT CO.
138 Grand St., N. Y. C. Tel. CAnal 6-6983-4

STEAM ENGINES
Turb. Cent. Bronze Pumps
Steam Pumps—All Sizes
10"x10" Greenfield Vertical
7"x7" Wickes Bros. Vertical
6"x6" Vertical & Smaller
1 to 40 H.P. Steam Turbines

11000 FT. SUR. COND.

AND AUXILIARIES

4000 K.V.A. COND.—NON COND. TURBO.

2—4166 GPM. 162' hd. Cent. Pumps (Prac. NEW)
36000-25000 GPM. 27'-40' Hd. Cent. Pumps
20" and 24" Valves—Ells—Tees—(Prac. NEW)
1500 CFM 2 Stage Aircomp. 275 HP. 60 Cy. 2200 V. Syn. Motor

ROSS POWER EQUIPMENT CO., Indianapolis, Ind.

BOILERS

NEW and USED

All makes & sizes for prompt shipment

We have an extensive list of good Used Boilers available . . . let us have your Inquiries.

J. F. DAVIS CO.
122 S. Michigan Ave. CHICAGO

FOR SALE BY OWNER

POWER PLANT EQUIPMENT

TURBO GENERATORS

2—10,000 K.W. Westinghouse 6600 or 2300 V. Complete with condensers, switchgear and all other auxiliaries.

BOILERS

5—760 H.P. B & W, forged steel headers, 225# pressure A.S.M.E. and National Board, superheaters, stokers and complete auxiliaries.
6—500 H.P. BW—200# pressure, steel headers, with stokers and superheaters. Conditions excellent, ready to operate.

TRANSFORMERS

UP TO 5000 KVA

3—2500 KVA.
9—300 KVA.
3—500 KVA.
Number of smaller sizes.

We buy complete plants outright!

WHAT *HAVE* YOU FOR SALE?

HOWE BROTHERS
324-328 Pearl St. New York, N. Y.
TEL. WORTH 2-2708-2709-2710

SYNCH. CONVERTERS

600 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

500 KW WEST. SYN. 250 V. 2300 A.C. 900 RPM
200 KW G.E. IND. 600 V. 2300/4000 A.C. 1200 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK CO.
Incorporated
502 Grant Building Pittsburgh, Pa.

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ALL SIZES-TYPES

A. G. SCHOONMAKER CO.
50 CHURCH ST. PHONE WORTH 2-0455
NEW YORK 7, N. Y.
BUSINESS ESTABLISHED 1898

We Sell, Buy, Repair & Calibrate

Switchboard and Portable type A.C. & D.C. all types electric meters. Ship to us any meters you have for repairs via freight or express. We shall gladly submit estimate.

Philadelphia Transformer Co.
2829 Cedar St. Phila., Penna.

APPLICATION ENGINEERS

Three 160 HP 240 Volt AC Diesel Gen. Units—Complete plant.
Four 5000 HP slip ring motors with variable speed control.
List your Surplus and Replaced equipment with us no charge. Send Specification of your needs.

HOWARD BLAINE JOHNSON & ASSOCIATES
53 W. Jackson Blvd., Chicago 4, Illinois

SYNCHRONOUS MOTORS

200 HP. 600 RPM. 3/60/220 V. General Elec. ATI
250 HP. 514 RPM. 3/60/440 V. General Elec. ATI
300 HP. 1200 RPM. 3/60/440 V. General Elec. ATI

SLIP RING MOTORS

150 HP. 720 RPM. 3/60/220 V. General Elec. IM
150 HP. 514 RPM. 3/60/440 V. Allis-Chalmers
200 HP. 600 RPM. 3/60/440 V. General Elec. IM

M-G SET

200 KW. single phase, 60 cy. 220 V. G.E. ASI gen. dir. con. 300 HP. 3/60/220 V. G.E. type TS syn. motor, complete with control

FREQUENCY CHANGER

60 KVA. 3 ph. 120 cy. Fairbanks Morse dir. con. 50 HP. 3 ph. 60 cy. 220 volt motor

STEAM GENERATOR UNITS

60 KW. 3/60/220 V. Westinghouse gen. dir. con. 13 x 12 Ideal piston valve engine, complete
250 KVA. 3/60/220 V. Westinghouse gen. dir. con. to Nordberg Unaflow engine, 160# steam

Rockford Electric Equipment Co.
721 South Wyman St. Rockford, Illinois

Reconditioned Motors, Generators, Control Equipment, etc.

Send for 32 page stock list.

Electric Apparatus Repair Company
Specialists on Rebuilding Motors. Generators and Controls
1410 No. 6th St., PHILA., PA.

FOR SALE

1—5 Ton P&H, 60' Span O.E.T. Crane. Like New
1—50 KVA Eng.-Gen. Set; 65 HP Loco. Boiler
1—30 KW, 1200 RPM, Belted AC Generator
2—150 HP, 150# P. Heine WT Boilers
1—675 KVA Gen. dir. con. Unaflow Engine
2—D-13000 Caterpillar Full Diesels
1—150 KW 220 V. AC Gen. D/C 4-Val. Eng.
1—400 HP, 165# ASME Heine WT Boiler

H. & P. MACHINERY CO., 6719 Etzel, St. Louis.

SLIP RING MOTORS
3-HP., 60-CY

HP	Volts	Make	Speed
900	2200	G.E.	900
350	220/440	G.E.	1800
300	2200	G.E.	1800
300	2200	Whse.	514
300	440–220	Al. Ch.	900
250	2300	G.E.	600
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–400	G.E.	600
150	440–220	G.E.	1800
150	440	G.E.	1800
150	550–2200	G.E.	1800
150	550	G.E.	720
125	2200	G.E. (NEW)	1800
125	440–220	G.E.	600
100	550–2200	G.E.	720
100	440–220	G.E.	1800
100	220–440	G.E.	720
100	220–440	G.E.	900
100	440–220	G.E. MTC	900
75	220–440	G.E.	900

SYNCHRONOUS MOTORS
3-HP., 60-CY

600	2200	Whse.	900
350	440–220	G.E.	900
300	440/220	Al. Ch.	600
200	2200	Whse.	900
110	440	Whse.	900
100	2200–550	Al. Ch.	1800
100	440–220*	G.E.	360
75	440–220	G.E.	720

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

UNAFLOW ENGINE-GENERATOR SET consisting of:
Gen: 250 KW 200 RPM 250 volt direct connected to:
Eng: 23" x 24" Ames Unaflow 125/150# ga. non-condensing. Very modern—practically new.
1—11" x 12" Ames non-condensing Steam Engine, direct connected to a 60 KW Crocker-Wheeler 250 volt DC Generator.

TRANSFORMERS
60 CYCLE

3—500 Kva., G.E., Type H, Form KDD 13200-2300 V.
3—500 kva., G.E., type H, form KS, 13800-230/460
3—333 kva., G.E., type H-KDD 2400-400/230.
3—250 kva., Whse., 13,800-460.
3—200 kva., G.E., type H, 34500-2300 V.
1—200 kva., G.E., type HT, 13200/26400/480 V. 3 ph.
3—150 kva., G.E., type H KDD, 6600/11430Y 1300 V.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Ch., type OISC 10400-2400.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., G.E., type H-KR 6600/11430Y-2300 V.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., whse., 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
600	440/220	G.E.	IK	1200
550	440/220	G.E.	IK	900
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	600
250	2200	Whse.	CS	1200
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
200	440/220	G.E.	IK	900
150	440/220	G.E.	IK	900
150	2200	Allis Ch.	AN	450
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	K1	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
60	550	G.E.	FT	3600
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

1—125 KW, 125 V., 1200 RPM, G. E. conn. to 175 HP, 1200 RPM, 440 V. 3 ph. 60 cy. Syn. motor.
1—75 KW, 250 V. 850 RPM, conn. to 110 HP, 440/220 V. Sq. Cage Motor.
1—50 KW, 250 V. 850 RPM, Whse. conn. to 75 HP, 440/220 V. 3 ph. 60 cy. Sq. Cage Motor.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—187 kva., 900 r.p.m., 550 V. Whse.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 96 kva., 360 r.p.m., 480/240 V. G.E.
1—62½ kva., 1200 r.p.m., 2200 V. Cy. Wh.
1— 60 kva., 720 r.p.m., 240/480 V., G.E.
1— 25 kva., 3600 r.p.m., 220 V., G.E.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

BOILERS

2—255 H.P. Heine W.T., A.S.M.E. 165#.
2—210 H.P. Heine W.T., A.S.M.E. 165#.
Complete with Enco oil burning equipment, pumps, heaters, etc.

STOKER

Huber overfeed natural draft, heavy duty. Suitable 350-500 H.P. boiler. Brand new. Immediate delivery. No priority.

M. J. HUNT'S SONS

1620 N. Delaware Ave. Phila. 25, Pa.

COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL

"Export Orders Carefully Executed."

SPECIAL OFFERINGS

1—2000 H.P. B. & W. 200# Boiler
4—1000 H.P. Heine 225# Boilers
2— 750 H.P. Edge Moor 200# Boilers
4— 600 H.P. B. & W. 200# Boilers
2— 600 H.P. Edge Moor 200 # Stokers
1— 570 H.P. B. & W. Sectional 200#
1— 600 H.P. B. & W. Stirling 200#, with Stoker
6— 440 H.P. B. & W. Sectional 200#. Oil fired
1— 335 H.P. B. & W. Sectional 200 Boiler
Smaller Boilers and Fire Tube Boilers also

1—15000 KW., G.E. Co., Turbo-Generator Condensing
1—10000 KW., G.E. Co., Turbo-Generator Condensing
1—5000 KW., G.E. Co., Turbo-Generator Condensing
3—4000 KW., G.E. Co., Turbo-Generator Cond.
2—2500 KW., G.E. Co., Turbo-Generator Condensing
2—2000 KW., G.E. Co., Turbo-Generator Condensing
1—2000 KW., W. E. & M. Co., Turbo-Generator Con.
3—1000 KW., G.E. Co., Turbo-Generator Condensing
2— 750 KW., G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller. And Non-cond. Units.

50 Ton 69'-10" Overhead Traveling Crane.

CHARLES B. REARICK 30 CHURCH ST. NEW YORK

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CUT TO SKETCH ⅛ to 24"

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PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
Large SURPLUS STOCK
STEEL-WROUGHT IRON-CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
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PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

AC Diesel Sets For Sale

500 KVA Worthington, little used
250 KW. 240 KW. & 140 KW. Fairbanks
250 KW. Winton in operation

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave. New York, N. Y.

COCHRANE (DEAERATING) HEATER

Dimensions, 8' long, 4' wide by 7'-6" high. 10" back pressure, 22" steam inlet, 6" water make up, 6" overflow, 10" pump connections. Capacity, 240,000# water per hour, heated from 50 degrees to within 5 degrees of temperature of inlet steam. drawings available.

H. P. BREARLEY
3423-91st. St., Jackson Heights, N. Y.

Motor Generator Sets—Synchronous Motors, Etc.

M-G SETS

1—West. 500 KW 275 or 600 Volt D.C. 720 RPM. 2300 Volt 80% P.F. 720 HP A.C.

VERTICAL MOTORS

1—Reliance fan-cooled 25 HP 1750 RPM 220/440 Volt

SYNCHRONOUS MOTORS
3 phase, 60 cycle, A.C.

1—Ideal 3-bearing 250 HP 600 RPM 440 Volt
1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt
G.E. 62½ HP 1150 RPM 440/220 Volt

SQUIRREL CAGE MOTOR SPECIAL
3 phase, 60 volts

5—West. frame 405, 20 HP 900 RPM TEFC 220 Volts.

D. C. EQUIPMENT

13—Clark Bulletin 5370 30 HP 230 Volt. D.C. automatic starters—none used over two months. A large number of adjustable speed D.C. motors from 5 to 150 HP

ALTERNATORS SPECIAL, Allis-Chalmers, 125 KVA 277 RPM 3 Phase, 60 cycle

The Electric Motor & Repair Co., Cuyahoga Falls, O.

POWER PLANT EQUIPMENT

GENERATORS

One 250 K.V.A. and one 300 K.V.A. Crocker Wheeler Generators direct connected to Skinner Tandem compound engines—480 volts—3 phase 60 cycle, switchboard, instruments, piping.

One 300 K.W. General Electric Generator, 2300 volts, 3 phase, 60 cycle, direct connected to Curtis Steam Turbine, 175 lbs. pressure—3600 R.P.M. with 15 K.W. G.E. direct connected exciter.

BOILERS

One 444 H.P. Union Iron Works water tube steam boiler 200 lb. working pressure, pulverized coal or oil fired.

PUMPS

One Quimby 4 stage Centrifugal pump direct connected to 75 H.P. G.E. motor—220 volts—3 phase, 60 cycle, 1750 R.P.M.—500 G.P.M. 150 lbs. pressure.

One American Well 2 stage Centrifugal pump direct connected to 30 H.P. G.E. motor, 220 volts, 3 phase, 60 cycle, 1750 R.P.M. 200 ft. head complete with magnetic starter and safety switch.

FEED WATER HEATERS

One Goubert feed water heater with brass tubes—330 sq. ft. heating surface.

One Cochrane feed water heater, 54" dia. x 48" long—1000 H.P. capacity.

ELECTRIC MOTORS

Induction Type—220 Volt—2 Phase—60 cycle

One 5 H.P. Burke—Type EB 5—1130 R.P.M.
One 5 H.P. Burke—Type EB 75—900 R.P.M.
One 7½ H.P. Robbins & Myers—Type K—850 R.P.M
One 10 H.P. Burke—Type EM 1.2—1200 R.P.M.
One 10 H.P. Burke—Type EM 1.2—900 R.P.M.
Two 20 H.P. Burke—Type EM 3—1200 R.P.M.
One 20 H.P. Crocker Wheeler—1170 R.P.M.
One 35 H.P. Burke—Type EM 4.5—900 R.P.M.
One 50 H.P. Burke—Type EM 4.5—1200 R.P.M.
One 150 H.P. Westinghouse—Type CW—1765 R.P.M.

EMSCO EQUIPMENT CO.

EMIL A. SCHROTH, *Owner*

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STEAM PUMPING ENGINES

1—Snow 8 MGD C&FW cr. Com. Opp. Type Cond. 26x54x17x36, with waterworks type condenser.
1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterworks type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. All fine cond.
1—Platt Iron Wks. Cr. Comp. C&FW Meyer Valve Gear Cond. 1000 GPM. Size 14x28x19¼"x18.

PUMP VALVES

Birch Valves for all types of reciprocating pumps.

LARGE GATE VALVES

1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod and Eyebolt. 100#.

BIRCH MANUFACTURING COMPANY

1523 Sedgwick St. Chicago, Ill.

Direct Current Diesel Plant

3—BUDA-LANOVA DIESEL GENERATING SETS Model 6-LD909, 5¼ x 7, 6 cylinder, 4 cycle, 900/1150 RPM, direct connected to: 3—55/67.5 K.W. Star Ball Bearing Generators D.C. 110/230/250 volt, type S.O. 94, compound wound.

Including fully automatic panel boards, voltage regulator, Motor generator and balancing sets, transfer pumps, etc., also 230 volt set of Philco heavy duty Batteries 420 amps hr., practically new. This is one of the finest and most complete plants offered in some time. May be seen in operation.

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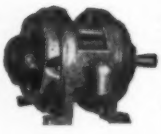
Main 4-3804

POWER EQUIPMENT COMPANY



OIL—AIR CIRCUIT BREAKERS

4—500 A. GE FK 12 3 PST 15,000 V. Handle, Trip Coils and Currents.
1—800 A. Condit E4 600 V. 3 PST. Handle, Trip Coils and Currents.
1—1200 A. GE FK 132 A 3 PST 7500 V. Handle with Trip Coils and Current Transformer.
1—2000 A. GE CK 8 Air Breaker 3 PST 600 V. O.I. & U.V.
1—3000 A. GE FK 25 Oil Breaker 3 PST 600 V. Solenoid operated with currents.

Sq. Cage.—220/440 V. 60 cy. 3 ph.

Qu.	HP	Make	Type	Speed
2	50	G.E.	KT 327	1800
2	100	G.E.	IK	1800
1	150	West.	CS	1800
	Slip Ring—220/440 V. 60 cy. 3 ph.			
1	40	West.	CW	720
1	50	G.E.	I-M	900
1	60	G.E.	I-M	900
1	75	West.	CW	900
1	250	West.	CW	1200
	D.C. Variable Speed 230 V.			
1	15	West.	SK	400/1600
1	25	West.	SK	400/1200
1	50	West.	SK	500/1500
1	50	G.E.	CD	400/1600

SEVERAL HUNDRED OTHER ITEMS IN STOCK
ABOVE ONLY SPECIALS—ALL REBUILT—STOCK SHIPMENT

154 ANDREWS ST. Tel. MAin 568 or 569 ROCHESTER 4, N. Y.

DIESEL ENGINES FOR SALE

2—180 HP Buda, model MAN, D-1742, 1100 RPM
1—120 HP Hercules, 1200 to 1800 RPM
4—150 HP 8¾x10½ Fairbanks, 500 RPM
1—420 HP 14x17 Fairbanks, 300 RPM
1—360 HP 14x17, Y-VA Fairbanks, 257 RPM
1—300 HP 14x17, Y-V Fairbanks, 257 RPM
1—200 HP 14x17, Y-V Fairbanks, 257 RPM
1—150 HP DelLaVergne, 225 RPM
2— 60 HP Y-VA Fairbanks, 257 RPM
1—125 HP Busch-Sulzer, 327 RPM
1—120 HP Y-VA Fairbanks, 257 RPM
1—120 HP Atlas-Imperial, 500 RPM
2—200 HP Atlas-Imperial, 600 RPM
1— 60 HP 4 cyl. vert. Marine Fairbanks, mod. 34
2—365 HP Busch-Sulzer, 16¼x21, 327 RPM

We can furnish above engines with or without generators. Also have large stock of AC & DC Steam & Natural Gas units, electric motors, hoists, cranes, pumps & etc. We buy complete plants. What do you have to offer?

GENERAL MACHINERY & EQUIPMENT CO.
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Telephone Victor 0018

COMPRESSORS

526 CFM Ingersoll Rand, Style "J"
940 CFM Ingersoll Rand, Type 10 hor. 2 st. steam driven, with receiver

CRUSHERS

24" x 54" Superior Crushing Rolls
No. 3 and No. 6 McCully Crushers

HOISTS & HOIST MOTORS

(Write for our complete list!)

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#2 Koehring 3-way comb. Crane, Dragline & Shovel
320-B 8½-yd. Electric Stripping

TRACTOR WAGONS

7, 7½ yd. cap. Allis Chalmers Speed-Aee Tractor Wagons

—— Request bulletin! ——

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60,000 gallon Water Tank on 89'9" tower, with 10" riser pipe.

IRON & STEEL PRODUCTS, INC.

13438 S. Brainard Ave., Chicago 33, Illinois.
"ANYTHING containing IRON or STEEL"

POWER PLANT BARGAINS

1—450 HP 6 cylinder, 4 cycle Full Diesel Engine, direct connected to Westinghouse 375 KVA, 3 ph. 60 cyc. 240 RPM AC Generator, dir. con. Exciter, Switchboard & Auxil. Equipment.
1—200 KW G.E. Turbo-Generator 3 ph., 60 cyc., 480 volt, 3600 RPM 150# non-condensing.
1—110 HP Washington 4 cyl. 4 cycle, Full Diesel Engine, 600 RPM.
1—100 KW G.E. Turbo-Generator 3 ph. 2300 volt, 60 cyc., 3600 RPM ATB 125# non-condensing.

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New or used. All types and sizes. Air and oil cooled. Phase changers a specialty.

ATLANTIC TRANSFORMER CO.
Transformer Specialists
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FOR SALE

250 H.P. E. Keeler Co., Long drum Water tube boiler, built 1929, 165#, complete with Huber stoker—A.S.M.E. & N.Y. Std.

VALVE & SUPPLY CO.

378 Bedford Ave., Brooklyn 11, N. Y.

1—175 HP Freeman Scotch Marine Boiler 130# pressure.
1—208 HP Johnston Firebox Boiler 160± pressure.
1—502 HP B&W Sterling Class 0-20 ASME 200# pressure complete with Riley pulverizer.

NELSON MACHINERY COMPANY
Green Bay, Wis.
HOME OF THE "PACKERS"

DIESEL UNITS

100 KW De LaVergne, 3/60/220 Volt Generator.
190 H.P. Buckeye, 3/60/440 Volt Generator.
225 H.P. Chicago Pneu. 6BCP, 6 cyl. 750 RPM Eng.
200 H.P. Fairbanks Morse, 3/60/2200 V. Generator.
280 H.P. Fairbanks Morse 32-D Diesel, 3/60/480.
360 H.P. Ingersoll-Rand, 3/60/2300 Volt Generator.
500 H.P. Fairbanks Morse 33-D Diesel, 3/60/480.

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

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1—1200 HP B&W Sectional Header Boiler, 250# pressure, underfeed stoker.
6—760 HP B&W Sectional Header Boilers, 225# pressure, with stokers, all auxiliaries.
1—526 HP Heine Boiler 350# pressure.
1—90,000# per hr. Badenhausen Boiler, 354# pressure
3—253 HP Vogt low head Boilers, 225# pressure with oil burners, all auxiliaries. New in 1937.
1—444 HP Union Iron Works Boiler, 225# pressure.
1—624 HP Edgemoor Boiler, 200# pressure, underfeed stoker
1—221 HP B&W Sectional Header Boiler, 250# Pressure, with oil burners.
4—72" x 18' HRT boilers including a 637 KVA General Electric condensing turbine. Complete plant.
2—175 HP Brownell HRT Boilers, 150# pressure, rebuilt.

TURBINES

2—5000 KW Westinghouse 3600 RPM 3-60-2300 volts Condenser, all auxiliaries.
1—3200 KW Allis-Chalmers Condensing Turbine with auxiliaries.
15,000 KVA Westinghouse turbine, condenser.
1—250 KVA Waite Turbine either condensing or non-condensing.

ENGINE GENERATOR SETS

1—625 KVA Nordberg Uniflow engine.
1—1060 KVA Nordberg Uniflow Engine Generator.

DIESEL ENGINES

1—200 KVA Fairbanks-Morse Full Diesel Engine Generator.
1000 KVA Diesel Generator Plant complete.
1—Busch Sulzer Full Diesel direct connected 1335 KW AC generator, rebuilt and guaranteed.
1250 KVA Nelesco engine generator

ENGINE GENERATOR SETS

1—340 KVA Skinner Uniflow Engine Generator set with panel board.
1—400 KVA Allis-Chalmers non-releasing Corliss.
1—625 KVA Bates Corliss engine.
1—7 ft. diameter by 175 ft. self-supporting stack.

MISCELLANEOUS

54,000 pound Cochrane hot process lime and water softener.
2500 HP Cochrane Open Feed Water Heater.
1—10' x 15' Illinois Forced Draft Chain Grate Stoker.
2—6 Retort Taylor Stokers. First-Class condition.
1—8 Retort Taylor, brand new stoker.
1—800 HP Hoppes open feedwater heater.
2—75 HP Elliott Geared 900 rpm turbines 385# steam pressure.
1—232 GPM Centrifugal Boiler Feed Pump, turbine driven, 1200 ft. head.

SEE Fletcher FIRST!

FLETCHER SALES CO.

325 Fincastle Building — LOUISVILLE, KY.

Priced low for quick disposal

One Allis Chalmers 150 K.W., 125 - 250 V. Erie Ball D.C.

ENGINE GENERATOR SET

SPECIFICATIONS

Generator	Engine
Serial No. 110332	Serial No. 6440
Amps. 600	Bore & Stroke 16 x 20
R.P.M. 200	Four valve,
Compound Wound	non-releasing

Equipped with Allis Chalmers 13.3 K.V.A., A.C. transformer and panel board.

In good operating condition

KELLY & CO.

2007 Olive St., St. Louis 3, Mo.

WURTH for "WORTH"!

A.C. GENERATORS 3 PHASE—1 PHASE 15 TO 62½ KVA

LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P.
D.C. MOTOR GENERATOR SETS TO 75 KW • HIGH CYCLE GENERATORS

Send For Our Latest Stock List

WURTH ELECTRIC MOTOR COMPANY

Motors, Generators, Alternators, Frequency Changers.
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FOR SALE

2—General Electric Traction Generators. 190 hp. Model 5-GT-555-A. 4 pole, D.C. commutating pole type. Designed for use with the 380 hp. 47 ton Diesel-Electric locomotive manufactured by the General Electric Co. These generators have never been in use. For further particulars write or cable the

FARBER ELECTRIC CO.

SAN JUAN, P. R.

GAS ENGINE

GENERATOR PLANTS

FOR SALE

In original crates,
No Priority,
Immediate Delivery

Continental 6-cylinder engine Generator Plants:
1800 rpm, 12.5 KVA, 3 phase, 120 V/208 V
1800 rpm, 9.4 KVA, 3 phase, 240 volts
1200 rpm, 9.4 KVA, 3 phase, 240 volts

Novo 4 cylinder engine Generator Plants:
1200 rpm, 8.75 KVA, 1 phase, 120/240 volts

Generators can be re-connected for other voltages at slight cost, before shipment. State second and third choices. Offered subject to prior sale. Contact us for details.

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Tel. KENmore 3012 - 6333

PUMPS

Rebuilt & Guaranteed

PUMPS—Large stock centrifugal—turbine—piston

STEAM PUMPS—Duplex - Simplex Reconditioned and guaranteed

BOILERS—stacks—Engine Generators—condensers.

LOU COHEN & CO.

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DIESEL ENGINES FOR SALE

2—200 H.P. BESSEMER FULL DIESEL ENGINES, Solid Injection, 6 Cyl., 4 Cy., 325 RPM, 11" x 14", Type J.R.S.
2—55 H.P. FAIRBANKS-MORSE MODEL 32D, YVA, 1 Cyl., 360 RPM, with Clutch and outboard Bearings.

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1,000 feet, more or less,

6" new galvanized pipe

A BUY

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Over 150 in stock

New and Guaranteed Rebuilt
Modern Plant doing Modern Rebuilding
From 50 CFM to 2500 CFM

AMERICAN AIR COMPRESSOR CORP.

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INDUSTRIAL & MARINE

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Power Plant Valves and Engineering Specialities for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24"
313 EAST 31st., NEW YORK CITY
For Hourly Nation-wide Shipments
CALL MUrray Hill 3-3466

CRETON PIPE & FITTINGS

1-250 H.P. HRT BOILER

147# W.P. complete fittings, suspension setting.

McDERMOTT BROS. CO.

Allentown, Penna.

Crowley-Duers Co.

DIESELS—GENERATORS—MOTORS
All equipment sold subject to operating test
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Phone 1468

WE OFFER:

the following equipment

Our property, located at Cargill Elevator, Port of Albany, N. Y.

4—Fairbanks Morse 60 HP, 6 cyl. 4 cycle Model 36, size 4¼"x6", 1200 RPM Diesel Engines.

4—Brunswick vertical 4 cyl. single acting, self-oiling eccentric drive compressors, bore 6" stroke 5¾", size C 354 ammonia compressors. Serial Nos 19662, 19661, 19447 and 18794.

5—Horizontal multipass shell and tube condensers measuring 15" in diameter x 216" long furnished complete with removable heads, bolts, gaskets, intermediate stands and floor stands.

1—Fairbanks Morse 1¼" Fig. 525 circulating water pump without motor.

4—Falk Gear Reducers Type 7 HC 50 HP.

Will Sell Individual Units or Lot Total. F.O.B. Foundation, Albany, N. Y.

WE OFFER:

2—100 HP Scotch Marine Murray Boilers, built to Hartford Code, complete with all accessories, located at the Mountain States Power Company plant at Riverton, Wyo. our property, subject to inspection at any time. Priced to move, with accessories, $1.000.00. Write or wire the undersigned, or our local agent, A. J. Moore, Worland, Wyo.

PORTER ELECTRIC COMPANY

612 Third Av. South Minneapolis 2, Minn. Geneva 8655

ELECTRIC POWER PLANT EQUIPMENT

FOR SALE

1—Sims-Pettibone Unit Pulverizer Size E-1-1000# coal per hour for 250 HP boiler capacity, complete with:—

1—Welded Steel Coal Hopper and Screen

1—15 HP. motor 550 V. 3P-60C-1750 RPM

1—Burner and connecting pipes, built in 1943.

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One—Chicago Pneu. Type 68-CP, 225 HP, 720 RPM

6 Cylinder Diesel Engine

Serial #30413, excellent condition operated less than 2 years—also auxiliary equipment including starting air compressor, 300 lb. pressure air tank, lubricating oil tank purifier, fuel oil transfer pump, and new spare parts, further details and price upon inquiry.

DIAMOND CALK AND HORSESHOE CO.
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60 H.P. Ames Economic Boiler—152 lbs.
50 H.P. Erie City Economic Boiler—100 lbs.

BERKS MACHINE COMPANY
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FOR SALE

1—General Electric. **Rotary Converter** Type T. C. 6-300-500 25 cycles Speed 500 Amps 500 Volts 600 Serial No. 114778 (one Field needs repairs) with G. E. operating Panel No. 124448 Ampere Meter D.C. Switch Rheostat & remote control 100 Ampere Oil Switch G. E. Type F. Form K2.

1—General Electric **Transformer** type H.R.T. Form R.R. 25 cycle. 330 K.V.A. Volts 13200/11880 370—180 Resistance 15% Serial No. 990819.

3—General Electric **Transformers** Type H.J. Form K.D.D. cycles 60. 100 K.V.A. approx. 10½% Reactance 150% 2 hrs. 60°C Volts 132000 to 445. 143 Gal. Oil, No. 10 G. E. transit instruction book 85204 Serial Nos. 3179015, 3179016, 3179017

1—**Rotary Converter** General Electric Type H.C.C. Form P. 300 K.W. C.C. Amps 500 D.C. Volts 600 60 cycles 1200 R.P.M. Serial No. 156008.

SWITCHBOARDS

1—General Electric 60 cycle **Rotary panel** 13200 volts 30 Amps.

1—General Electric D.C. **Rotary Panel** Type C.S.R. 300 K.W. Amps 800 Volts 600

1—General Electric **Starting Panel** R.E. 014519 Type A.T.R.S. 300 H.V.A. Amps 770 Volts 360

1—Westinghouse **Induction Motor** Type C. 3 H.P. Atts 3000 Amps 5.7 Serial No. 186926. 25 cycles

1—Westinghouse **Induction Motor** 20 H.P. E. M. F. 143 Gal. Oil No. 10 G. E. transit, instruction speed 750 Atts 3000. 25 cycles Serial No. 149568

1—A.C. and D.C. **Motor Generator Set.** Westinghouse type C constant speed induction motor 20 H.P. E.M.F. 335. Amps per terminal 32 3 phase full load speed 720 Atts 3000 Serial No. 149569. Generator D.C. 15 K.W. E.M.F. 120 Amps 125. Speed 720 Serial No. 149384. D.C. Generator 15 K.W. E.M.F. 550 Amps 27.3 Speed 720 Serial No. 149385

12—General Electric D. C. **Feeder Panels** Capacity 1500 Amps Each equipped with G. E. 1500 Ammeter Single Knife Switch and circuit Breaker No. 290742 Type C Form P. Volts 650

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107 Main St., Worcester 8, Mass.

50 KW DIESEL GENERATOR

75 HP Superior engine, Model GA6, 1200 RPM, direct connected Star AC generator and exciter, 3/60/120/208, Floor mounted switchboard, intake and exhaust silencers, vibration dampers, Factory and exhaust silencers, vibration dampeners. Factory rebuilt. Modern, compact. Shown in operation.

CROWLEY-DUERS CO., White Plains, N. Y.

WANTED

WANTED TO BUY FOR ST. LUKE'S HOSPITAL, CHICAGO, ILLINOIS

Cylinder Complete with Cylinder Head, Piston and Valves for 17 x 17 Fleming 4-Valve Engine

Manufactured by HARRISBURG FOUNDRY AND MACHINE COMPANY

Length of Cylinder Casting: Flange to Flange 32 inches

Please reply to:

VERN E. ALDEN, *Engineers*
120 South LaSalle Street Chicago 3, Illinois

Offered Subject to Prior Sale

300 H.P. McIntosh-Seymour Diesel Electric Generating unit, 3 Cyl., 4 Cycle air injection Direct Connected to G.E. Type TRE, Form D.S. Generator, 2300 volts, 3 phase, 60 cycle, also direct connected exciter. Immediately available in Central Kansas.

165 H.P. Busch Sulzer Diesel Electric Generating Unit, 4 Cyl., 4 Cycle air injection Direct Connected to G.E. Type TRE generator, 3 phase, 60 cycle, 2300 volts. Shaft extension for exciter, but no exciter. Immediately available in Southwestern Kansas.

E. M. PATCHEN, *Purchasing Agent*
THE KANSAS POWER COMPANY
Great Bend, Kansas

WE BUY FOR C A $ H

SEND LISTINGS AND PRICES
TRANSFORMERS CONTROLS
MOTORS MOTOR GEN. SETS
AIR OIL CIRCUIT BREAKERS

POWER EQUIPMENT COMPANY
156 Andrews St., Rochester 4, N. Y.
Telephone Main 568 or 569

WANTED

350 to 400 KVA Generator connected to a steam turbine for 115# steam pressure and 10# back pressure. Give serial number.

Evangeline Pepper and Food Products
ST. MARTINVILLE, LA., U. S. A.

FOR SALE

50 K.W. A.C. 2 Phase 60 Cycle Harrisburg Piston Valve Steam Engine Generator unit. Excellent running condition. Can be seen in operation.

WHITE LAUNDRY, INC.
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New SEARCHLIGHT Advertisements

received by February 15th will appear in the March issue, subject to space limitations.

Departmental Staff
POWER
330 W. 42nd St., New York 18, N. Y.

SEE PAGE 360

Announcement of

INTERNATIONAL POWER MACHINERY COMPANY

A Good Man to Know—

Your local PLIBRICO Representative—

● YOUR local Plibrico sales and service organization can show you a better, quicker solution to every phase of your furnace lining and boiler setting problem. This organization is the gateway to all the accumulated "know how" of the Plibrico engineering department—the source of supply for Plibrico Jointless Firebrick and other Plibrico products . . . *immediate* supply from local stock.

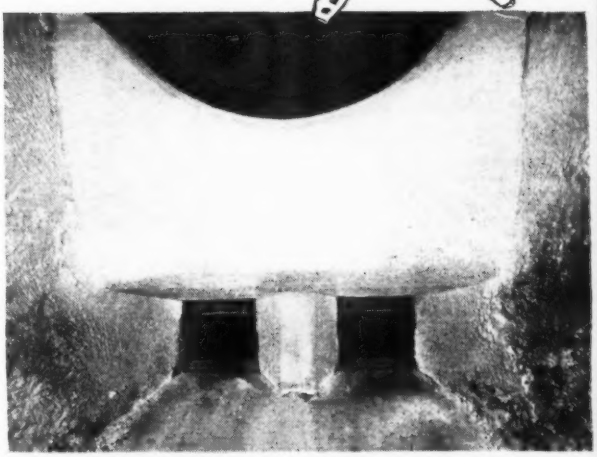
From the construction of complete boiler settings to minor repairs, your local Plibrico distributors can handle your complete requirements. Through the use of Plibrico products, they can give you longer-lived monolithic linings and arches . . . can provide air-cooled linings where extreme conditions prevail . . . can replace inefficient furnace and baffle designs with modern developments . . . can, in fact, handle any refractory need in a manner that cuts maintenance, delays, and boiler outages.

Work interruptions can't be tolerated today. Plibrico refractories, construction methods, and service will eliminate unscheduled interruptions insofar as your furnace linings are concerned.

Plibrico representatives are located in over 100 cities in the United States and Canada. In most cases, you will find them listed in local phone books as the Plibrico Sales & Service Co. Phone your local distributor or write for catalog covering your type of boiler. (Specify type of boiler.)

PLIBRICO JOINTLESS FIREBRICK CO.
1818 Kingsbury Street (Dept. B) Chicago 14, Illinois.

PLIBRICO *Jointless* **FIREBRICK**



● In the H.R.T. boiler furnace, Plibrico Jointless Firebrick forms durable walls and arches, fits snugly around the boiler shell. Plicast castable refractory is recommended for the rear arch. Ask for catalog covering H.R.T. boilers.

● In the water tube boiler furnace, monolithic Plibrico withstands high ratings, eliminates special tile shapes, meets every refractory requirement. Ideal for suspended arches and air-cooled walls. Ask for catalog covering water tube boilers.

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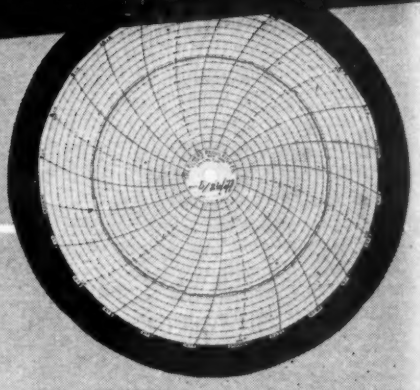

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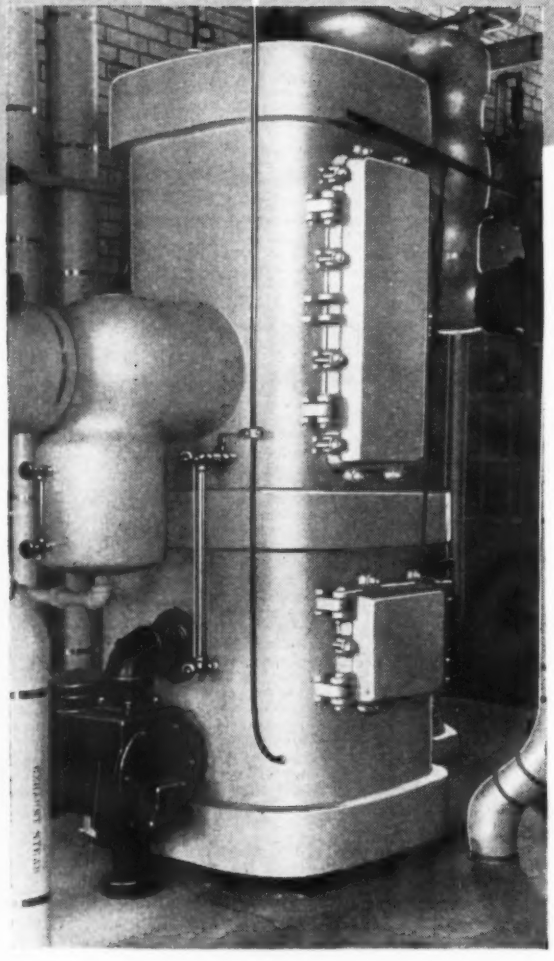

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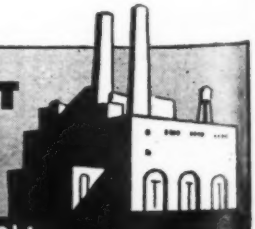

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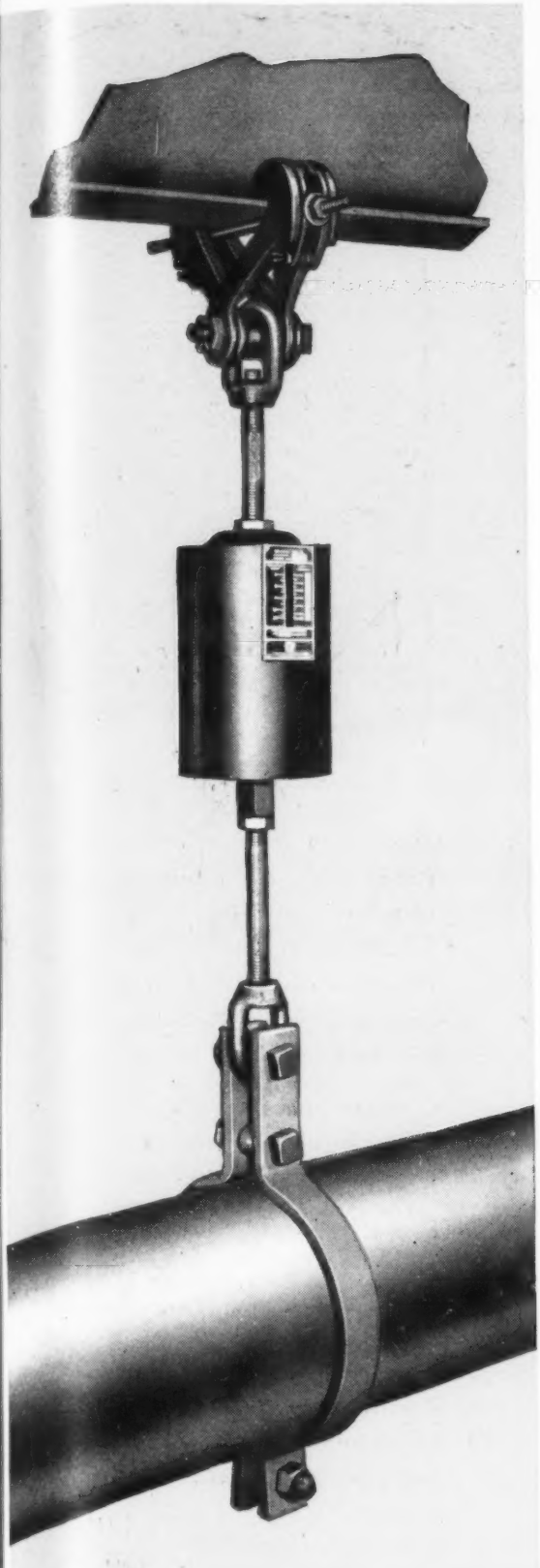

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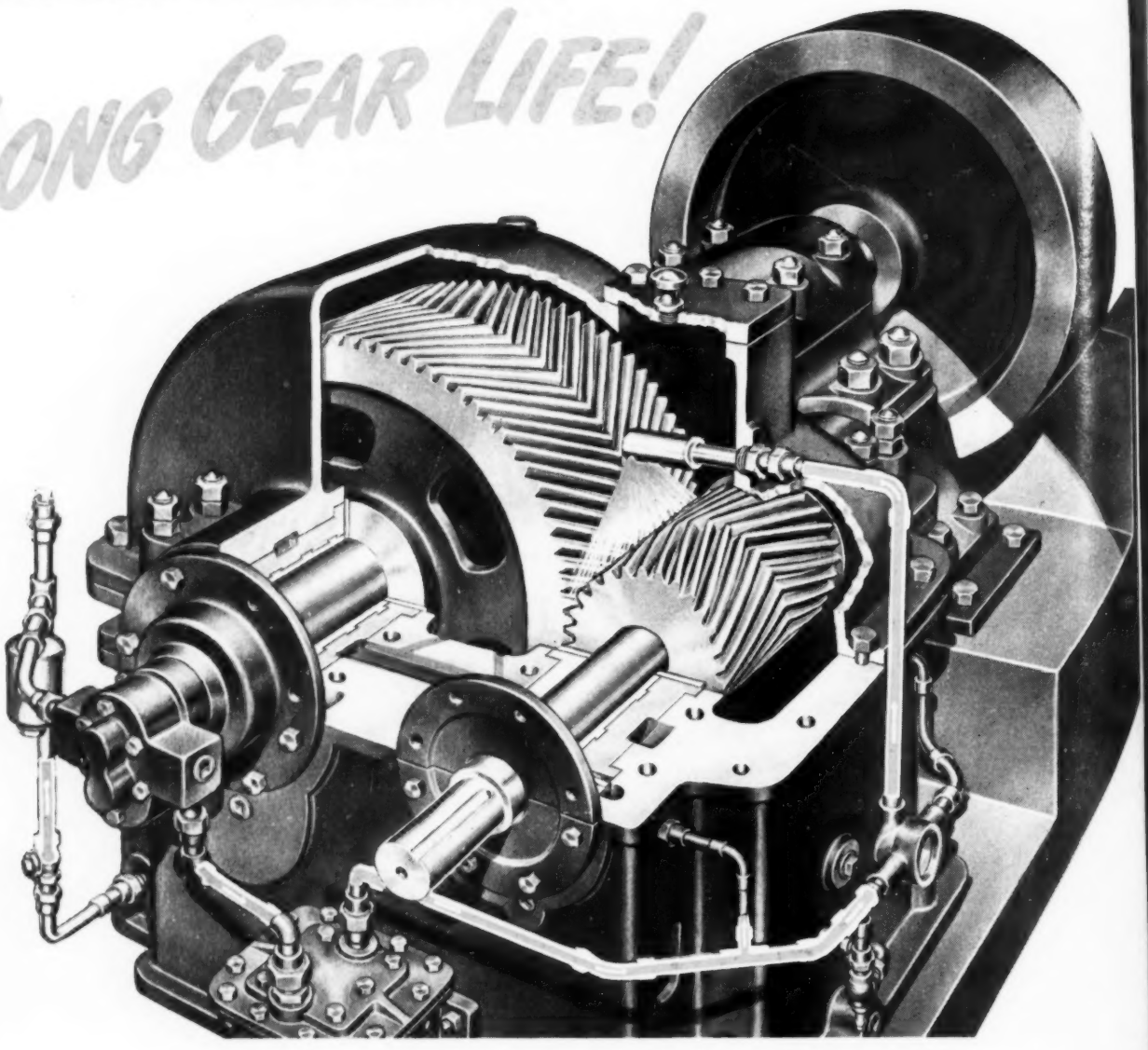

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